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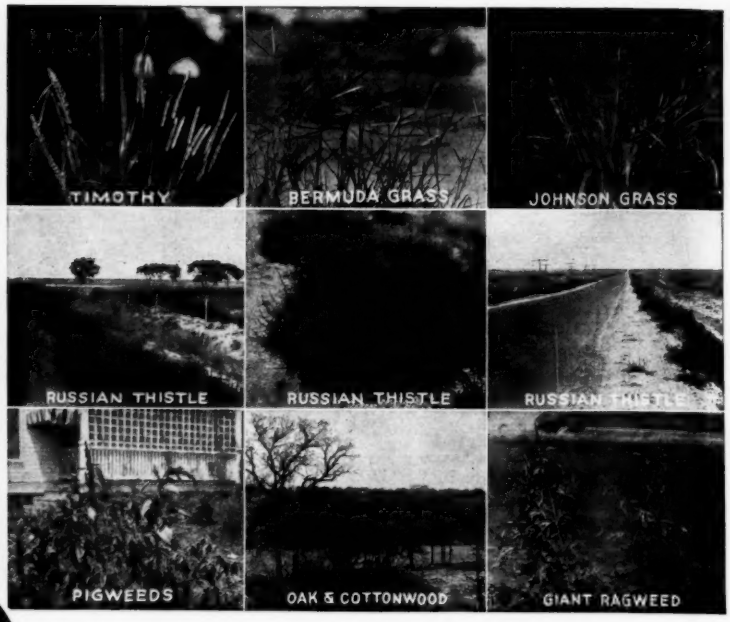

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Volume 18 JULY, 1935 Number 7

TOTAL THYROIDECTOMY FOR HEART DISEASE*

ELLIOTT C. CUTLER, M.D.†

Boston, Massachusetts

I HAVE long been puzzled why Dr. Judd was so gracious as to ask me to present before you this second Judd Lecture, but on thinking it over I have decided that there must be something peculiar in the relationship between Dr. Judd and myself since, though our ways do not cross any more often than they cross the paths of a multitude of other colleagues, I at least have long reserved for him a special place in my affection. Now I have a reason for this, a reason arising from our first meeting in the year 1915. At that time I was Resident Surgeon at the Massachusetts General Hospital, Boston, and during my vacation made my first trip west of the Hudson River. I scarcely expected to see Indians or buffaloes, but I did look upon this excursion as a most exciting occasion in my education!

I stopped first in Chicago, where my notebook of that day tells me that Dr. Albert J. Ochsner threw me into a turmoil of excitement during my visit to the Augustana Hospital. He operated without gloves, talked volubly most of the time; the patient suffered from goiter and the ether anesthesia was induced through a large mask; this "ether cone" obviously interfered with the operator so that, when the patient was prepared, Dr. Ochsner swept the mask to the floor and proceeded to remove the goiter. The game apparently was to get the goiter out before the patient woke up! It was exciting as well as highly instructive. On the same day I had visited Dr. Allen Kanavel at a hospital in the same city and had seen him operate with great anatomical and surgical skill upon a badly infected hand. That very day I saw three badly infected hands brought to Dr. Ochsner's operating room at the close of his morning's work. He himself dressed them, and told me he rarely practiced incision, that if the arm was put to rest and heat applied most infections of the hand would get well. Thus I left Chicago greatly confused and considerably excited, and went to Rochester, Minnesota.

My chief, Dr. C. A. Porter, had given me letters to Dr. Will Mayo, who happened to be away. I fell first into the hands of Dr. Beckman, whose writings concerning postoperative pulmonary complications had interested me, since I had recently studied this matter and found that almost two per cent of all patients at the Massachusetts General Hospital suffered from pulmonary complications and that, of these, 50 per cent died, whereas Dr. Beckman had reported about 1 per cent morbidity over several years and in one year no mortality in this morbidity! I had expected to learn much concerning how to avoid these complications but in going around in the afternoon I thought I recognized, although I dared not speak of it, many cases with mild postoperative pulmonary complications!

Later during my visit I fell into the hands of Dr. Judd, who was most gracious to an unknown young man, a matter for which I still retain the deepest gratitude. His surgery impressed me greatly. His operating room was quiet, his surgery expeditious yet gentle, and he completely won my devotion because of the friendliness with which he accepted suggestions even when they came from junior associates. I greatly sus-

*Second E. Starr Judd Lecture, University of Minnesota Medical School, Minneapolis, February 19, 1935.

†From the Department of Surgery, Harvard Medical School, Boston.

pect that the high position Dr. Judd now holds in American surgery is in no small part due to his ability to surround himself with young men whose enthusiasms and ideas have greatly benefited his professional career as well as allowed him to retain his youthful appearance of twenty years ago. And perhaps my being here is because Dr. Judd realizes how much I too like to associate myself with young men, to whom I also owe a deep debt of gratitude for both consciously and unconsciously received education.

Dr. Wangensteen, your Professor of Surgery, has been good enough to allow me to discuss with you the effect of *total thyroidectomy in the treatment of heart disease.* I am led to present this matter not so much because of its novelty as a therapeutic measure as because it brings up two other matters of general interest. In the first place, it offers a newly acquired principle of surgical thought in that we see the surgeon directing his attack, not at the diseased part of the body, which has been his aim heretofore, but at a part of the body distinct from the diseased organ. The surgeon has at last acquired physiology in addition to anatomy, a momentous occasion, as all first-year students know! The surgical procedure is now directed at a healthy and normal part of the body because the surgeon knows that a shift in the function of that part of the body may improve the condition in a distant and diseased part. This, gentlemen, may represent only a fragment of the surgery of the future. You have doubtless had discussed before you the rôle of the adrenal glands in certain disorders and have heard how peptic ulcer, diabetes, and even epilepsy may be modified by adrenalectomy; you know of the operations which are proposed upon the sympathetic nervous system for vasospastic and obliterative arterial disease, for painful conditions and for megacolon; you have heard of operations upon the spinal cord, such as ventral root division, for hypertension. It is apparent that the application of surgery is undergoing a profound change, of which this procedure of total thyroidectomy is but a single example.

One can imagine that such an attitude of mind will do much for modern surgery. It is a matter first introduced, perhaps, in the surgery of the sympathetic nervous system, for Lériche in his installation address at Strasbourg in 1925 emphasized a day when shifting the nerve or blood supply to a part might bring about changes which would lead Nature eventually to heal the diseased organ without ablation of the part, a form of surgery now distasteful to all modern surgeons.

And again it is important to emphasize this step because mental disciplines and attitudes of mind are the most valuable matters your teacher can give to you. Unfortunately too much instruction may, as you perhaps already know, be harmful, for too much teaching robs one of the opportunity to make an accurate observation. Aristotle wrote that no one over twelve could make an accurate observation because, as he correctly points out, one then makes the observation, not of a phenomenon as it actually is, but of the phenomenon translated through one's past education. It has been partly this which has led to the fact that a great many of our forward steps in science, or at least in applied science, have been made by individuals on the frontiers of civilization rather than by the academicians in the universities. Thus in the field of surgery it was Ephraim McDowell, on the frontier of Kentucky civilization, who first opened the abdomen for ovariotomy, not his distinguished teacher, the great Bell of Edinburgh; and in a recent book entitled "All in a Day's Work," which is the reminiscences of Abraham Groves, a country doctor of Fergus, Ontario, we read of the first application, on the frontier of Canadian civilization, of the sterilization of instruments by boiling as early as 1874, though Lister at this time had hardly begun his antiseptic method. We see at that date successful ovariotomies and vaginal hysterectomies under the aseptic method which university men were not to practice for another twenty years, and we see Dr. Groves on May 10, 1883, removing the appendix for acute appendicitis, though the momentous paper by Reginald Fitz was not written until 1886.

Thus, gentlemen, it is more important that we point out to you how to study and give you attitudes of mind than that we spoon-feed you with the information of our day. Possibly this small contribution of mine today will fall on some fertile mind and lead to a further enrichment of the medical field. I am presenting the matter, therefore, with the hope that it will be a

stimulus to your mental attitudes as well as of some value to you later on in your own practice of medicine.

Let us now examine into the *background* and the *reasoning* for ablation of the normal thyroid gland in heart disease. Obviously the removal of such an important normal structure must rest on firm grounds.

I. *Laboratory evidence.* Beginning in 1925 Dr. Herrman L. Blumgart began to investigate the rate of blood flow. These studies culminated in his being able to show a definite relationship between the rate of blood flow and the thyroid function as measured by the basal metabolic rate. He studied patients in many pathological conditions and also normal individuals. Gradually he accumulated evidence that the rate of flow was increased in exophthalmic goiter and slowed in myxedema, the speed of the circulation roughly paralleling the basal metabolic rate. The observation was also made that in cardiac failure the rate of flow was considerably lowered. These observations led Blumgart and his co-workers to suggest that when the circulation in decompensated heart disease could not be speeded up by digitalis, rest, and other appropriate cardiac therapeutic methods, then compensation might be achieved by lowering the demands for an adequate circulation through thyroidectomy. Such a procedure should decrease the speed of circulation as the demand for a normal speed was diminished by the falling basal metabolic rate. It was expected that at some point the crippled supply, as measured by the rate of blood flow, would come into equilibrium with the lowered demand imposed by the thyroidectomy and thus compensation would result. Such reasoning based on the careful studies preceding it seems to justify thyroidectomy in patients with circulatory failure. The original human attempts along this line consisted of subtotal thyroidectomies, and such cases corroborated the hypothetical reasoning in that, as the basal metabolic rate dropped, a point was reached where compensation was achieved. The relief in such cases, however, was only temporary, for with regrowth of the remaining fragment of the gland the basal metabolic rate was restored to normal and coincident with this the demand upon the circulation went back to its previous level, a level which the cripped heart could no longer maintain, resulting in a return of the clinical signs of circulatory failure.

II. *Clinical evidence.* Equally important with the laboratory evidence are the observations which have been made at the bedside of people ill with thyroid disease over many years. It will not surprise you to recall that both Billroth and Kocher were among the first to remove the thyroid gland, but it should be remembered that the early operations were lobectomies or total thyroidectomies, not subtotal removals, since the modern operation was not developed by Kocher until 1890. These surgeons made the observation that an unexplained but great improvement appeared following thyroidectomy in certain patients in whom circulatory failure had been present. From that time on evidence constantly accumulated that there is a relation between thyroid and cardiac functions. It was gradually noticed that a certain number of patients with decompensated heart disease, in whom a preëxisting history of thyrotoxicosis was obtainable, were entirely relieved of their cardiac failure syndrome by subtotal thyroidectomy. In this thyrocardiac group, even in the presence of fibrillation and marked symptoms of failure, those remarkable restorations to an almost normal circulatory function occur after subtotal thyroidectomy. But the story is not to be told only in terms of the basal metabolic rate, for evidence has been presented by Morris that hearts damaged by thyroid activity occur in individuals in whom the basal metabolic rate has not been elevated, as if that part of the secretion of the thyroid that damaged the circulation was not necessarily a part of the substance which controlled the basal metabolic demands. This idea has only lately assumed a rôle of major importance and now we find some observers placing a reliance upon the cholesterol level equal to that placed upon the basal metabolic rate as an evidence of thyroid activity. Thus, though many observers have reported brilliant results in certain cases with advanced cardiac disease and mild thyrotoxicosis following thyroidectomy, it is possible that the level of the basal metabolic rate is not the best way of determining the "thyrocardiac group."

But there is a great deal more evidence of this thyrocardiac relationship, for there are tucked away in medical literature case reports of arrythmia and tachycardia relieved by thyroidec-

tomy, and more recently Frank Wilson of Ann Arbor has found the relationship of the thyroid to cardiac function so close that he has presented evidence and statements that Graves' disease may be recognized by an examination of the heart even before there has occurred an elevation of the basal metabolic rate. This interrelationship is seen again in non-toxic goiter cases, for both Reid of Cincinnati and Coller of Ann Arbor have shown that following the subtotal operations upon patients with endemic goiter circulatory abnormalities disappear. This interrelationship of the thyroid and the heart, as observed in the clinic, has stimulated a certain amount of laboratory investigation and we now know that the administration of thyroxin to animals produces an alarming disturbance of the cardiac function.

The observations given above, including both laboratory and clinical work, seem to join closer and closer together cardiac and thyroid functions. Finally, the evidence that thyroidectomy may slow the rate of flow has justified the removal of what appeared to be normal thyroid glands in an attempt to balance supply and demand in *decompensated heart disease.*

Before attempting to show you some of the effects of total thyroidectomy, let me make one more attempt to clarify the above reasoning by use of a chart. The compensation clock (Fig. 1) is an attempt to show the parallelism of circulatory efficiency and the basal metabolic rate.

You will recall that the basal metabolic rate is in direct relation to the circulatory rate and that these factors must remain in equilibrium in order to have compensation. If circulatory failure develops, there is slowing of the speed of the circulation. If the basal metabolic rate remains normal, the speed is well below that demanded by the basal metabolic rate and therefore decompensation results. If one tries to push circulatory failure up toward normal by the use of digitalis and rest and cannot push it up to its normal level, the only way one can bring the rate of circulation into equilibrium with the basal metabolic demands is to drop the latter to the same level. This can be accomplished by thyroidectomy. By total thyroidectomy one can drop the basal metabolic rate to any level desired. If the circulatory rate is only a little slowed by circulatory failure, then the basal metabolic rate need only be dropped to a point just below normal. This point can be determined by the re-establishment of compensation and measured by studies of the speed of circulation in relation to the basal metabolic rate. The desired level can be maintained by administering the proper amount of thyroid extract.

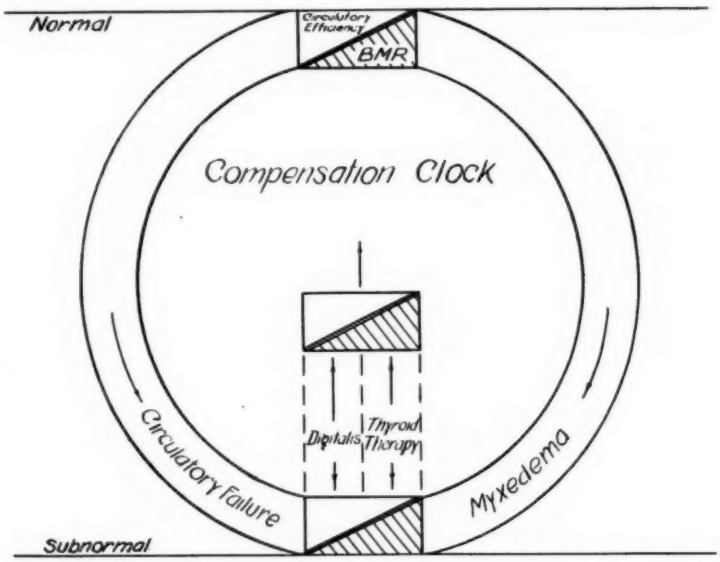

Fig. 1. Compensation clock.

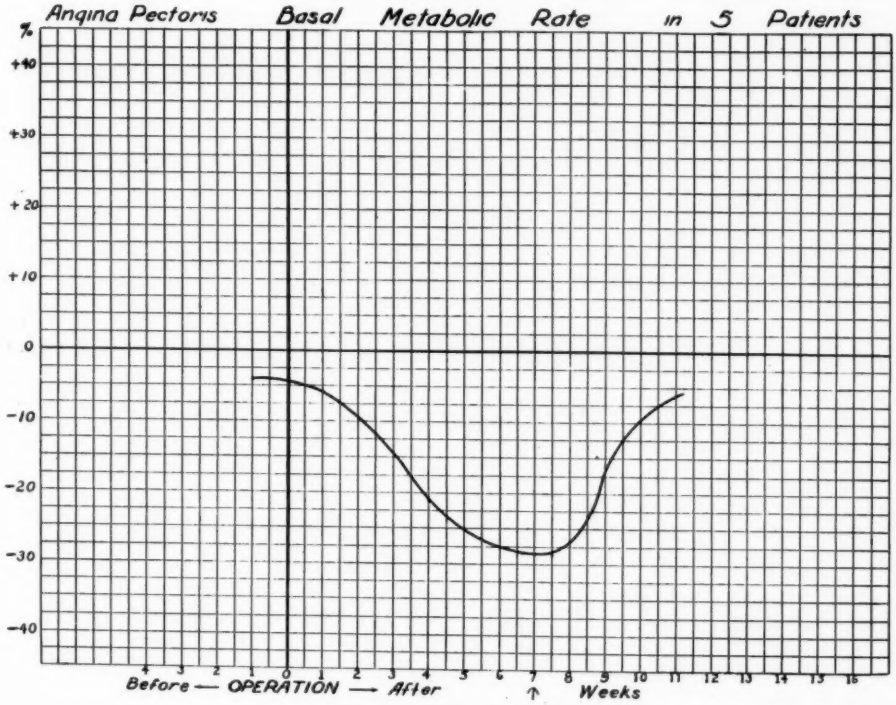

Fig. 2. Basal metabolic curve.

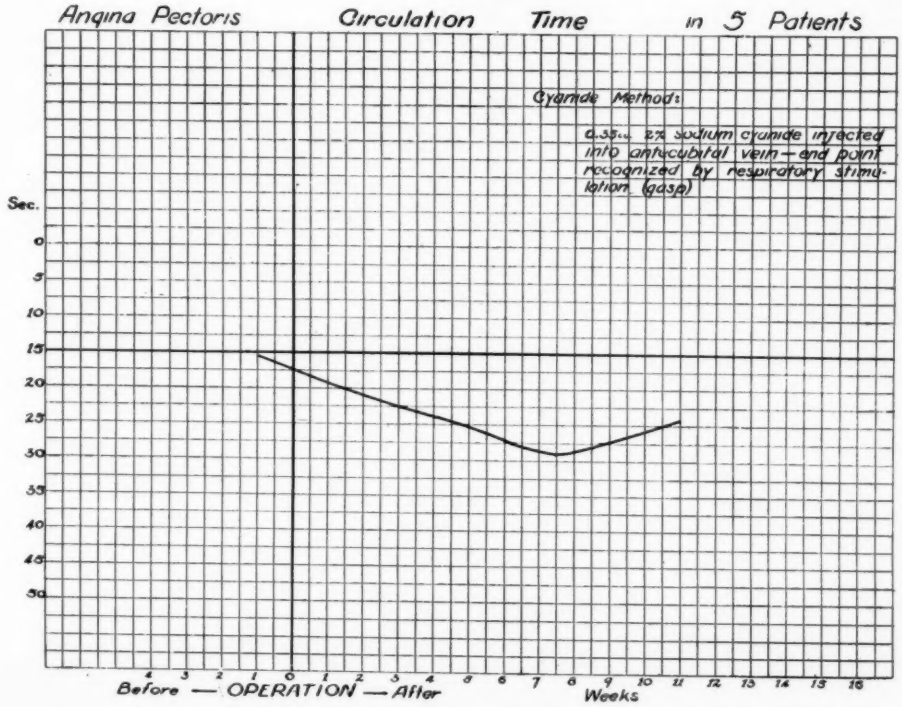

Fig. 3. Circulation time curve.

Now let us study certain reactions to thyroidectomy which are definite and which always occur. First, the basal metabolic rate. Fig. 2 shows the average curve of five patients with angina pectoris following total thyroidectomy. Note the steady drop in the basal metabolic rate until at seven to eight weeks a basal metabolic rate of —28 is reached. At this point thyroid therapy was commenced and one sees the restoration toward a former normal level.

Figure 3 shows the circulation rate response to total thyroidectomy. Again we see the average of the studies in five patients. The method used is the cyanide method. We inject into the antecubital vein 0.35 c.c. of a two per cent sodium cyanide solution and test the end point by sudden respiratory stimulation which is usually recognized by a deep gasp. The end point is definite and easily noted. The normal rate for this test is from fifteen to sixteen seconds in healthy young adults. It was twenty seconds in our angina pectoris patients who had no evidence of failure but whose age was above the average utilized by Robb and Weiss. We see in this curve that again in about seven and one-half weeks the rate is doubled in time, slowing from close to fifteen seconds to close to thirty seconds. Again with the use of thyroid extract at this time the curve can be reversed and the rate brought back to normal.

Another classical reaction is seen in Figure 4 in the blood cholesterol curve. Here, starting with an average level of around 300 mgm. per cent, we see at seven weeks an average of 420 mgm. per cent. With the administration of thyroid extract at this time the curve is again restored toward normal. In this particular study five patients with angina pectoris were utilized. Taking all of our angina pectoris cases (twenty-two patients), the average preoperative blood cholesterol was 230 mgm. per cent, whereas in the cardiac failure group, a somewhat younger group, it was 182 mgm. per cent. The normal may be roughly between 150 and 250 mgm. per cent. In our series the highest cholesterol level attained in myxedema was 744 mgm. per cent, with an average for all patients in the angina pectoris group of 475 mgm. per cent and in the failure group of 315 mgm. per cent.

In Figure 5 we have superimposed all these curves showing the reversibility of all procedures with thyroid therapy. Once having arrived at a level where either pain has disappeared in the angina pectoris group or compensation has been achieved in the failure group, thyroid therapy has been begun. We found that utilization of 0.015 gm. of Armour's thyroid extract daily would, as a rule, maintain patients at any desired level. If we wished to push the basal metabolic rate back toward normal a little further, 0.030 gm. of extract was given for a short period of the time and when the desired level was reached again it could be maintained by the lower dosage.

Further control studies in all patients concerned the usual blood chemistry determinations. The blood phosphorus level was not affected by total thyroidectomy to any great extent, though in two cases with mild symptoms of parathyroid deprivation where the blood calcium level was lowered the phosphorus level rose slightly. Blood calcium levels were affected only in those cases where accidental removal of parathyroid substance caused symptoms of mild tetany. No cases of serious tetany have arisen and in only five cases has there been enough irritability to suggest clinically the condition of parathyroid insufficiency. In these patients a Chvostek sign and Trousseau sign could be elicited. In one case the blood calcium dropped as low as 6.8 mgm. per cent. The slight tetanic signs which appeared were alleviated by viosterol, twenty drops three times a day, and three grams of calcium lactate by mouth three times a day. These substances seem to be even more efficacious than parathormone, which was utilized in only two cases for control studies of the calcium levels. The patient with the blood calcium as low as 6.8 has gradually in a year and a half built this level up to within normal limits and is without further signs or symptoms.

Determinations of sugar tolerance were carried out on most of the patients and the results may be summarized as follows: (1) in patients presenting normal blood sugar levels total thyroidectomy brought about no appreciable change; (2) in patients with diabetes, our observations have shown that as these patients entered myxedema there was an increased tolerance to sugar. Thus one patient, starting with a fasting blood sugar of 400 mgm. per cent and requiring 75 units of insulin a day in addition to dietary restriction, is now, a year following total thyroidectomy, showing occasional insulin reactions

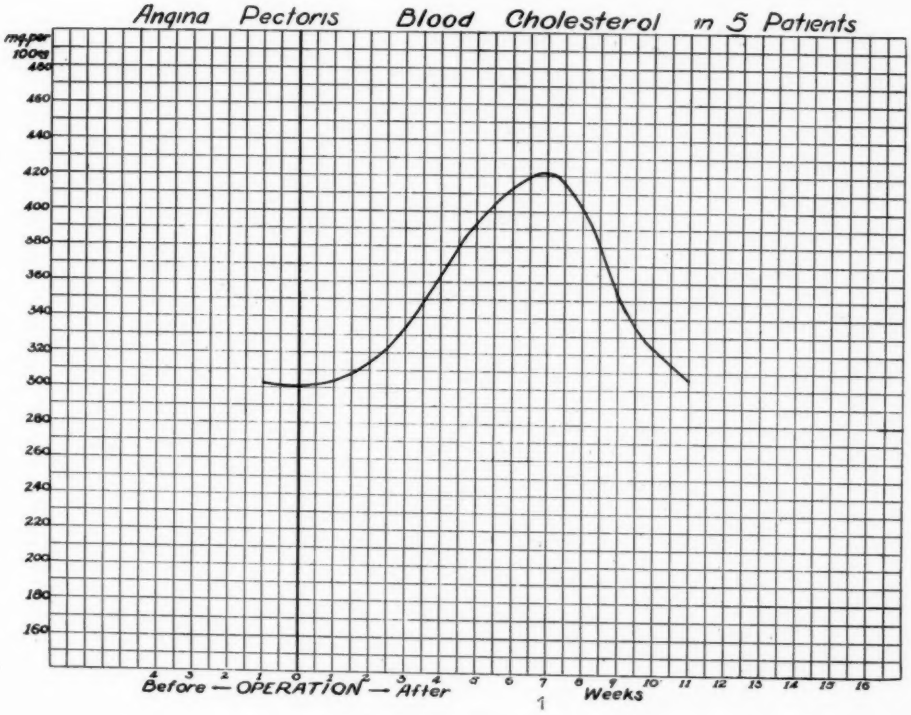

Fig. 4. Blood cholesterol curve.

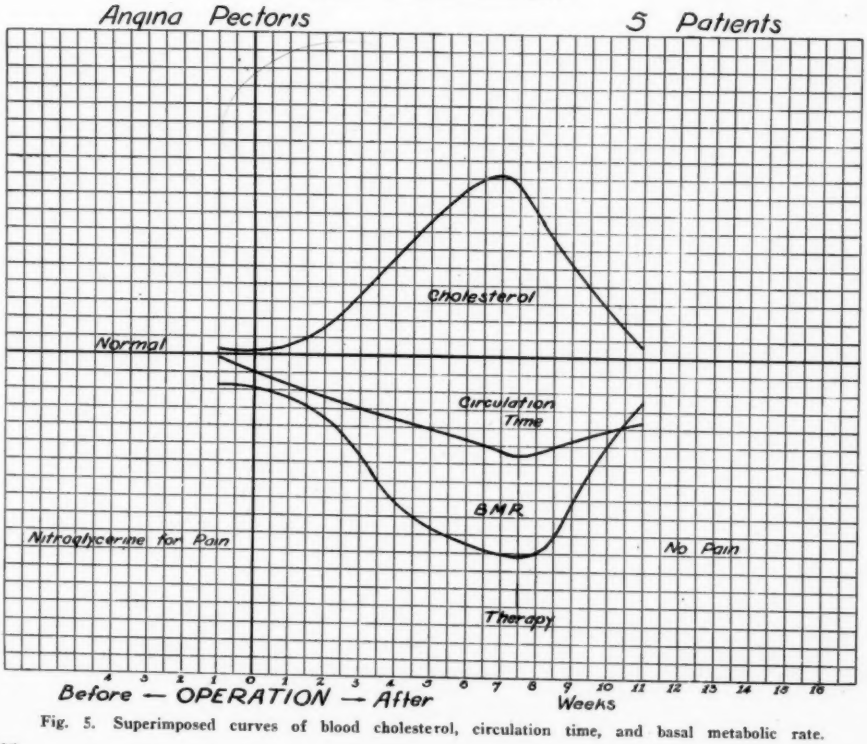

Fig. 5. Superimposed curves of blood cholesterol, circulation time, and basal metabolic rate.

though receiving only 20 units of insulin a day with the same diet. This patient does not show the clinical signs of myxedema and the basal metabolic rate is maintained at —15. This fragment of the work is reserved for a future presentation, for the interpretation of what has occurred is not yet clear.

Observations were also made of the skin temperature reactions of all these patients before and after total thyroidectomy and these may be summarized as showing an increased vasodilator ability following total thyroidectomy. Thus patients in myxedema show an initial low skin temperature, probably due to the infiltration of skin with fluid. Such patients, however, when subjected to vasodilator stimuli, reveal a rise of temperature to a higher level than that obtainable before total thyroidectomy.

Many other tests were carried out in order that in such a new undertaking we might protect our patients as well as learn as much as possible concerning man's ability to survive under the conditions imposed by total thyroidectomy. One of our chief worries has always been the mental status which might result from total thyroidectomy. For that purpose competent individuals in psychiatric research set up for us a large number of both simple and intricate symbol tests. All patients were submitted to these intellectual ordeals before total thyroidectomy and their sensory and motor mental responses standardized. Studies at this time, averaging in the survival cases about eight months, show no loss in their intellectual ability to respond. In fact, for the moment the responses are, if anything, exalted and patients in mild myexedema show greater facility mentally, as regards both their sensory and motor mental functions, than before total thyroidectomy.

Other popularly conceived ideas of the effect of total thyroidectomy were checked upon. Thus a summary of the blood pressure studies of all the cases shows an average rise of blood pressure of 10 mm. of mercury systolic and 10 mm. of mercury diastolic at the end of sixteen months of observation. Studies of the blood itself, since anemia is taken as one of the signs of myxedema, show at the end of this same period of observation some slight secondary anemia. Further studies concerned sex function, though many of the patients are of the older group and thus the test is limited in numbers. Inquiry has shown a return of sex life in three males who considered themselves impotent before thyroidectomy, and in one case a woman who had not menstruated for four years has now resumed normal menstrual periods.

This résumé of the results which follow total thyroidectomy in man can perhaps be visualized to you in the following cases:

First, a case of *angina pectoris:* M. P. was a German housewife of sixty who complained of burning pain beneath the sternum radiating to the left arm, with exertion, for the last eight years. The amount of pain, the duration of the attack, and the frequency of attacks steadily increased until for the last two years before entering the hospital she had been bedfast and had taken nitroglycerine in increasing amounts daily, though recently it had only slightly diminished her pain. The blood pressure was 170/70; the liver was 8 cm. below the costal margin; electrocardiogram showed left ventricular preponderance. Figure 6 visualizes part of her course. Note that as the basal metabolic rate fell the velocity of blood flow was slowed and at the same time her cholesterol rose. Finally, when the basal metabolic rate had reached —28, thyroid medication was started and the curves all commenced to reverse themselves. At present, with a basal metabolic level of —15, there is some slowing of the circulation and some slight elevation of the cholesterol. This patient has remained an active housewife without pain except for one occasion when she carried a large amount of coal into her lodging house. She now takes automobile rides, does her housework, and has changed from a bedfast patient to an individual with an active life free from pain. At the same time, she is kept above the clinical myxedema level by thyroid medication.

Let us now take a case of *valvular disease:* C. C., thirty-three years old, was a married garage worker and at the time he entered the hospital complained of shortness of breath. This was his first bout of failure, which began some two months before admission, with dyspnea on exertion, finally orthopnea, pain in the epigastrium, pounding of his heart, swelling of his ankles and cough. On admission he was orthopneic, dyspneic and cyanotic. The heart was enlarged 14 cm. to the left, and there was a marked rumbling diastolic murmur and a loud blowing systolic murmur. The rhythm was grossly irregular with a pulse deficit of 20. There were râles at both bases, edema of the feet, ankles and legs, and his liver was four fingers' breadth below the costal margin. For ten weeks he had rest in bed and digitalis in every form and in large amounts without any effect. Then he was submitted to total thyroidectomy. In ten days the liver was beneath the costal margin, he was able to sleep flat in bed and finally, after two months, he took a job driving a truck, which he is still able to continue to do at the

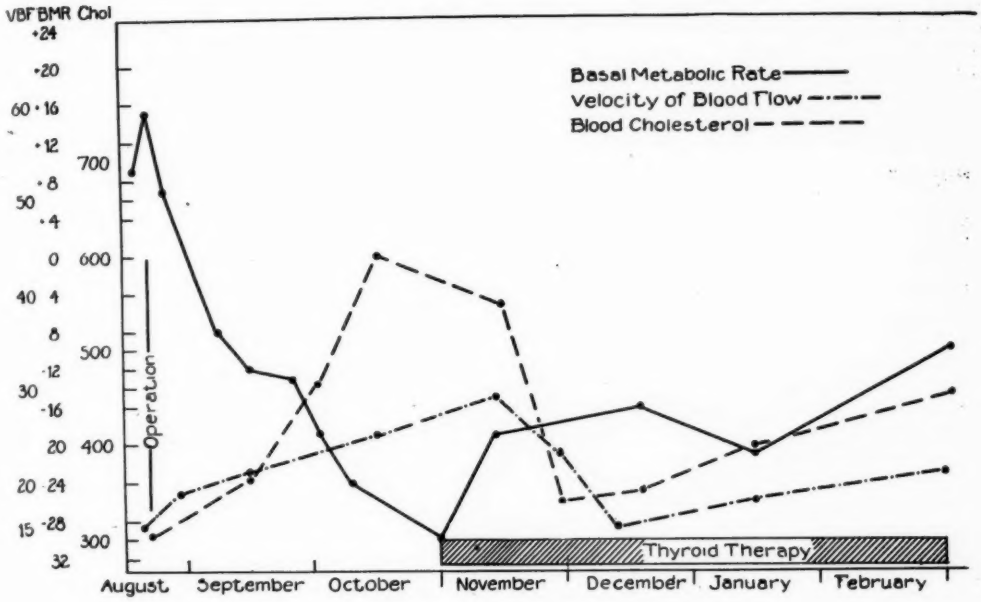

Fig. 6. Studies of basal metabolic rate, velocity of blood flow and blood cholesterol following total thyroidectomy in a case of angina pectoris.

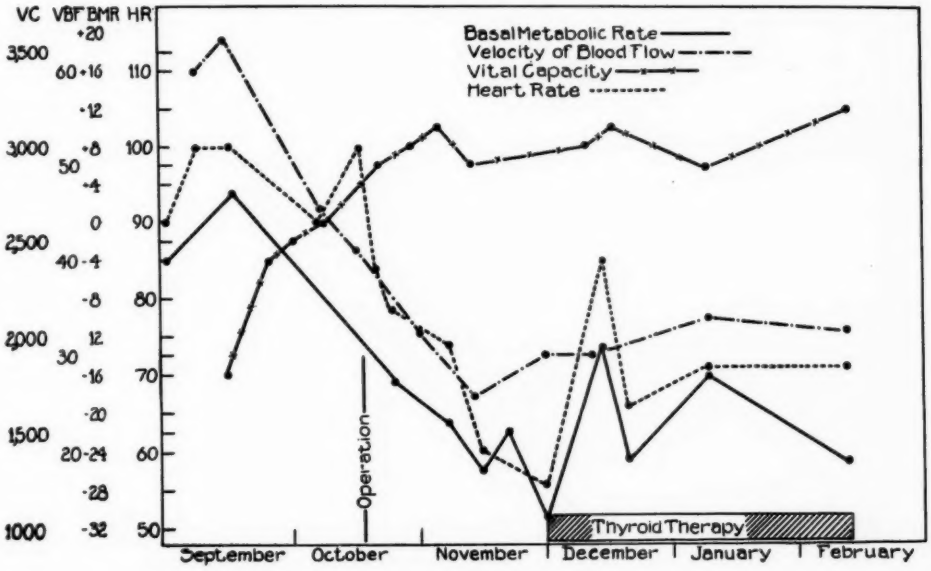

Fig. 7. Studies of basal metabolic rate, velocity of blood flow, vital capacity and heart rate before and after total thyroidectomy and later following the addition of thyroid therapy in a case of cardiac decompensation with mitral stenosis.

present time, sixteen months following the operation. Figure 7 shows the early part of his hospital career. Note that following his operation the basal metabolic rate fell steadily. With its fall the vital capacity rose. The heart rates slowed but the velocity of blood flow increased.

In this patient we see the reverse of the expected happening, for the speed of circulation is *increased* by total thyroidectomy and the resultant myxedema. This will frequently happen in patients with severe decompensation, for as thyroidectomy lowers the demand upon the circulation compensation results, and actually the speed of circulation demanded by the myxedematous condition is faster than the speed of circulation present in decompensation. Once compensation is achieved, the speed of circulation follows the basal metabolic demands and is faster than the speed present in severe decompensation.

Next let us consider a patient with *chronic myocarditis:* L. W. was a colored male of forty-three who complained of shortness of breath and easy fatigability for four years. Within two years he had become incapacitated and had had several severe attacks of substernal pain on exertion. Then paroxysmal dyspnea had appeared and he had started to take digitalis. About six weeks before admission he had become bedfast, edema of the feet and ankles had appeared, respiratory rate was unstable, mental confusion had set in and he was finally brought to the hospital in a semi-comatose condition. On admission there was Cheyne-Stokes respiration, great mental confusion, blood pressure 210/144, hemorrhages in both retinæ, enormous heart enlarged to the left with a loud systolic murmur at the apex, and a grossly irregular rhythm. The liver was 8 cm. below the costal margin and there was marked edema and râles in both bases. A long medical regimen with digitalis, salyrgan, and rest failed to bring about compensation and finally he was submitted to total thyroidectomy. He now works as janitor at a fire station, comes to the clinic on foot when desired, seems comfortable and, except for troublesome ascites, is relieved of pain and his decompensation. Figure 8 shows a fragment of this man's clinical course, largely that part which visualizes how all these reactions can be made to reverse and shift with thyroid therapy. At a period late in his postoperative course thyroid medication was forced in order to study what would happen to this patient if his basal metabolic rate was restored to normal. Note that his basal metabolic rate, which was around —40, was pushed up to just above normal with thyroid medication. As the metabolic rate ascended toward normal, his heart rate mounted rapidly, and his vital capacity fell to within alarming limits. Coincident with this there reappeared the complete picture of cardiac decompensation which he presented upon admission. Thyroid therapy was then withdrawn, the basal metabolic rate fell to its previous level around —30 and the patient abruptly became compensated.

Finally, let us study Figure 9: S. G., a woman of forty-nine already had severe *spontaneous myxedema* and had been under observation for five years in our Out-Door Department. Gradually over a period of years, her metabolic rate having been restored to around —20 through thyroid medication, she developed typical angina pectoris. Because of theories concerning angina pectoris which are shortly to be spoken of, we felt that thyroidectomy, though you may well smile at removing the thyroid from a patient already severely myxedematous, might benefit her. Therefore, total thyroidectomy was carried out and, to be sure, there was a thyroid gland, largely composed of fat, but containing within its capsule and scattered throughout the fat within the thyroid capsule many thyroid acini easily picked up under the microscope. Following this total thyroidectomy the basal metabolic rate was allowed to drop to —40, was held there for a period of time, and finally was brought up to its preceding level of —15 to —20 without the return of angina. In such a case one may hypothesize that desiccated thyroid extract does not contain all the principles of thyroid secretion.

TABLE I. SURGICAL MORTALITY AND MORBIDITY STATISTICS.

Total Number of Cases		54
Cardiac Decompensation		
Valvular Disease	15	23
Myocardial Disease	8	
Deaths		
Immediate Postoperative	2 (8.7%)	8
Late Unrelated to Operation	6 (26.1%)	
Angina Pectoris		31
Deaths		
Immediate Postoperative	2 (6.5%)	7
Late Unrelated to Operation	5 (16.1%)	
Complications		
Parathyroid Tetany	5 (9.3%)	9
Recurrent Laryngeal Nerve Injury	4 (7.4%)	

I presume you must be somewhat interested in clinical results though I myself feel that the observations made which do not relate to the cardiac aspects of this problem are quite as important or even more important than those which actually relate to applied therapy at this time. We have to date removed sixty-four normal thyroid glands in this particular study, some, as suggested, for diabetes and for peripheral vascular disease in addition to cardiac disorders. Table I covers a fairly recent summary of our clinical work. You will see that the cases are divided into those with cardiac decompensation and those with angina pectoris. The immediate mortality rate has been low, lower perhaps than one might hope for in patients with these disorders should they have to be subjected to any other similar surgical procedure. Indeed, since patients with angina decubitus (for all the patients in the angina group were patients with pain even at rest) are threatened with disaster daily, we may look upon the figures in either group as a remarkably low immediate postoper-

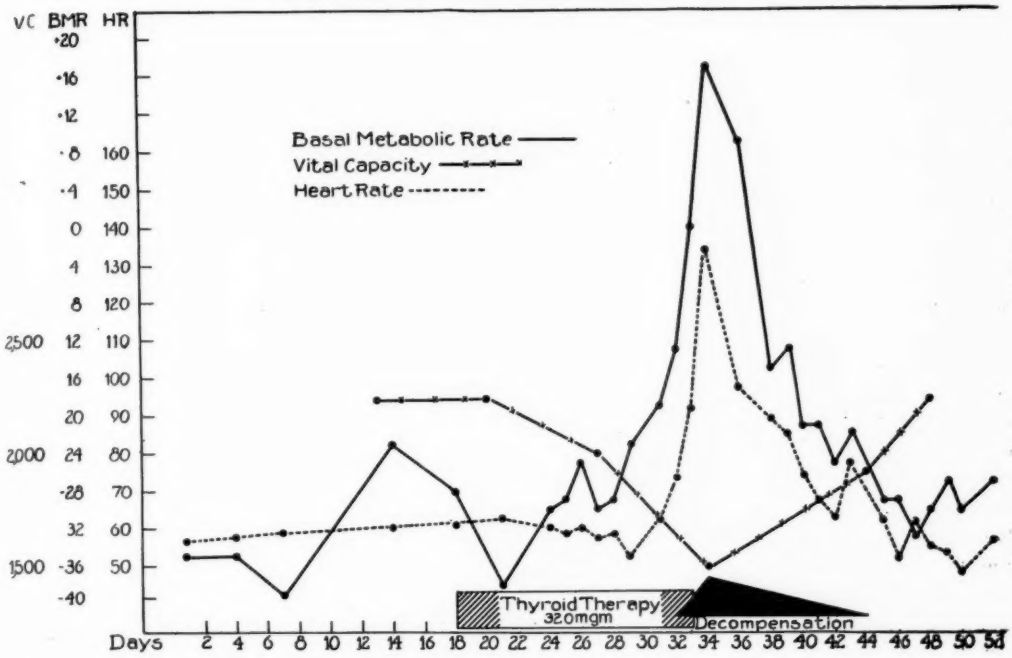

Fig. 8. Chart showing the effect of thyroid therapy upon the basal metabolic rate, vital capacity and heart rate in a patient with cardiac decompensation due to failing hypertensive heart disease at a period some months after total thyroidectomy, and showing the ease with which physiological reactions can be reversed.

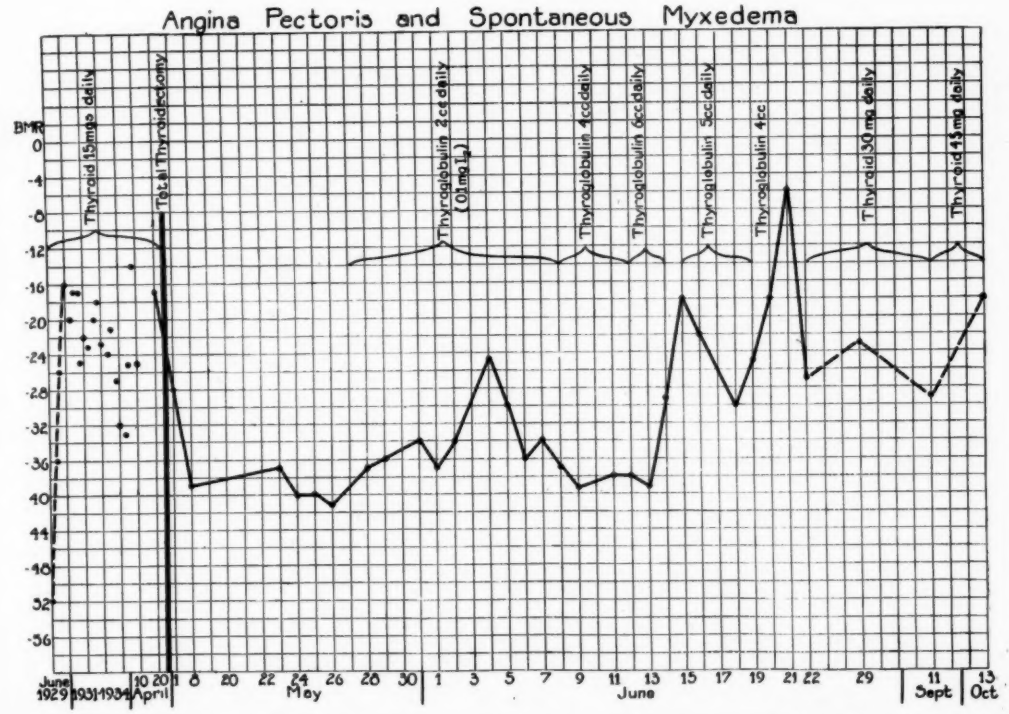

Fig. 9. Chart showing the basal metabolic rate studies on a case of spontaneous myxedema with angina pectoris before and after total thyroidectomy.

ative mortality. No patient has died during the operation; the two immediate deaths in the cardiac decompensation group come within the group of myocardial disease, elderly males with failing hypertensive heart disease whose myocardial reserve was insufficient to stand any excess burden and whose hearts steadily failed following the operation. In the group of angina pectoris, the two immediate deaths were apparently classical attacks of coronary closure on the first and second postoperative day, attacks similar to those which had occurred previously in these patients and which might have been expected at any moment. The later deaths have all been recorded, since the matter of longevity in patients following total thyroidectomy is an interesting speculation. Two of the patients died elsewhere during operations for gallstones though we, knowing these patients had gallstones, carefully warned them not to submit to operation for this disorder. In the group of cardiac decompensation the later deaths were typical of cardiac failure, some with infarcts preceding the final failure and some simply cardiac failure alone.

There were no particular complications, though mild signs of parathyroid tetany as already described occurred in the five cases and there was injury to the recurrent laryngeal nerve in four cases. These recurrent nerve injuries occurred early in our attempts to carry out this procedure and were due to my insisting upon operating from the right side only, a position I had always assumed for simple subtotal thyroidectomy, and it was only when I had injured three left recurrent nerves while operating from the right side that I learned to remove each lobe while operating on the homologous side. Visualization of the recurernt nerve is the only essential feature of the operation and this can best be done from the side on which it lies.

The operation itself presents no other difficulties. We have utilized local anesthesia throughout all procedures, preceded by a fairly good-sized dose of morphine. We have never had to divide the pretracheal ribbon muscles and once the gland was exposed and its extent ascertained, for one must remember a pyramidal lobe should be followed to its very limits, the upper pole vessels were ligated above the capsule and the gland attacked at its inferior limits, first dividing the superficial veins, then identifying the recurrent nerve and sweeping the gland away from it. We have always found the recurrent nerve to loop through branches of the inferior thyroid artery and we have never seen it except as an extra-capsular thread. It has been reported by others to lie within the substance of the thyroid gland. I can only say that in sixty-four cases this has never been the case.

TABLE II. CLINICAL RESULTS IN THIRTY-FOUR PATIENTS WHO HAVE LIVED MORE THAN THREE MONTHS SINCE OPERATION.

Group II	Cardiac Decompensation (10 Valvular disease, 2 Myocardial)	
	Excellent	5
	Good	4
	Fair	3
	Total	12
Group II	Angina Pectoris	
	Excellent	12
	Good	4
	Fair	6
	Total	22

Excellent—restored to active life without complaints.
Good—greatly improved but inactive (decompensation cases) or occasional pain (angina cases).
Fair—improved but still incapacitated.

Table II reveals our final statistics and has been compiled by three separate observers of the records and of the patients themselves. Considering that all cases were of the most serious type, the results are gratifying. It must be remembered that the people in the heart failure group were all bedfast individuals, unrelieved by modern medical means, and that all the people in the angina group had angina decubitus, that is, frequent attacks of pain without effort. Many in both groups have been restored to a fairly active and comfortable life.

There remains one fragment of this work which I trust you have already questioned. That is the explanation of why people with angina pectoris are given relief, for people with angina pectoris do not necessarily have cardiac failure and in our group, though they were the seat of angina decubitus with pain at rest, their circulatory efficiency was fairly normal. We have set up, therefore, a new explanation for the relief in this group of cases. Angina pectoris is a disorder in which it is generally accepted that the painful seizures represent periods of myocardial ischemia, an explanation warranted by the frequency of coronary occlusive disease in most patients suffering from the disorder. One might

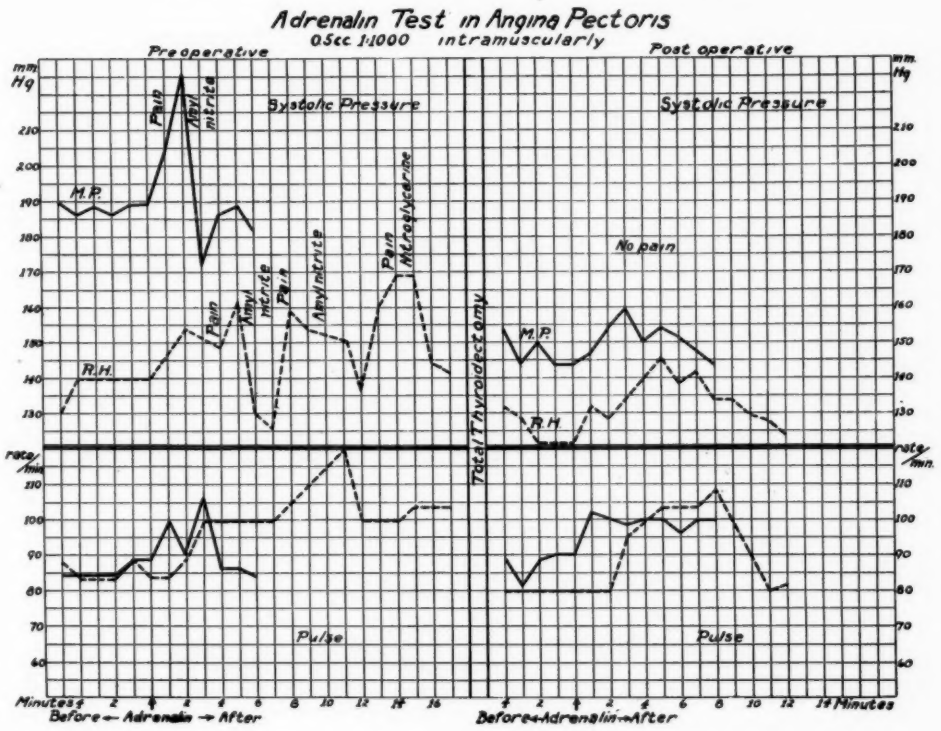

Fig. 10. Adrenalin tests in angina pectoris.

say that in such cases dropping the demands upon the circulation by lowering the basal metabolic rate would give to the individual patient an added factor of safety in that the occasional added exertion, if the patient was living at the limit of cardiac capacity, might bring about symptoms. However, in the absence of any diminution in the speed of circulation we have felt that the reasoning applied to the relief in failure cases could not be applied to angina cases. Early in our studies we made a special observation concerning the response of these patients to adrenalin.

Thus you will see on Figure 10 blood pressure records of two typical cases of angina pectoris before and after the administration of adrenalin. You may recall that the subcutaneous injection of adrenalin has been utilized already by cardiologists for unmasking the "formes frustes" of angina and it has been shown that the subcutaneous injection of adrenalin, with sudden rise in blood pressure will often call forth a typical anginal seizure. This is not a matter for routine use and should be attempted only by specialists thoroughly competent in this field, since provoking such attacks may bring on attacks of coronary closure. Note on the chart that the patient M. P., starting with a systolic pressure of 190, showed following the subcutaneous injection of 0.5 c.c. of 1-1000 adrenalin an abrupt elevation of pressure, the systolic pressure reaching 225. Coincident with this there was excruciating substernal pain with typical radiation to the arm. Amyl nitrate was administered, the pressure abruptly fell, the pain disappeared and a normal situation ensued. Within twelve hours of total thyroidectomy note that her resting blood pressure was 155. Again 0.5 c.c. of 1-1000 adrenalin was injected subcutaneously, there was very slight elevation of the blood pressure, which rose only ten points, no pain was induced, and the patient remained normal and comfortable. The next day into this patient was injected subcutaneously 1 c.c. of 1-1000 adrenalin. Again there was no pain.

In the other case, R. H., the same phenomena

were noted. With the injection of adrenalin there was some elevation of pressure with pain, relief with amyl nitrate, spontaneous recurrence of pressure and pain as the amyl nitrate effect

Fig. 11. Application of string about coronary vessel of dog in experimental angina pectoris.

wore off, more amyl nitrate with again absence of pain and reduction of pressure, again spontaneous recurrence of pressure, again and final lasting relief on the administration of nitroglycerine. In this patient also twelve hours after total thyroidectomy no pain occurred with subcutaneous injection of adrenalin.

This observation, which has been repeated, would seem to be of great importance in understanding the mechanism of painful seizures in angina, for it would seem that total thyroidectomy modified in our patients the action of adrenalin. To study this mechanism further a simple experimental study was set up. We utilized the Sutton and Lueth coronary occlusion method (Fig. 11). A dog's chest was opened, a string passed around the major descending coronary vessel, the string led out through a glass tube and the chest closed. When the animal was conscious, pulling on this string provoked pain recognized by the struggling of the animal and shifts in breathing and other measurable symptoms and signs. This method had been utilized previously to support the contention that coronary occlusion was a cause of anginal seizures. With such a preparation we found one could weight the threads, which were passed over pulleys, and that weighting these threads up to a certain point did not cause pain. Such a method is seen in Figure 12. With this method the following experiments were carried out. Adrenalin was injected without weighting the string (Fig. 13), using a simple vasopressure dosage amounting to 0.1 c.c. of 1-1000 solution intravenously. Such an injection causes no pain in the animal. However, if the strings are weighted with 100 gm., which of itself would produce no pain but which does produce mild coronary occlusion, then a repeated dose of adrenalin of the same amount produces excruciating angina. These two observations would seem to indicate that the output of the adrenal gland plays a rôle in the occurrence of anginal pain.

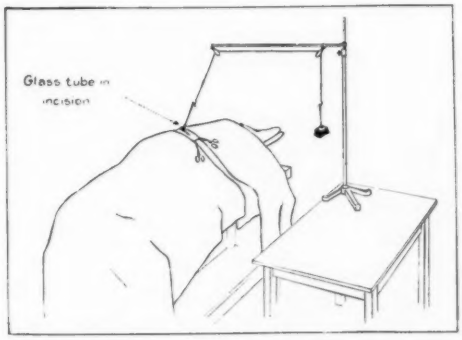

Fig. 12. Method of weighting string in experimental angina pectoris.

We know that total thyroidectomy does not modify the output of adrenalin but these observations would seem to point to the fact that, though the output of the adrenal gland is not modified, the substance produced is less effective under the conditions imposed by total thyroidectomy. There is further clinical evidence to support this thyroid-adrenal mechanism in angina since we have no adequate explanation today unless we invoke this relationship for explaining attacks of angina when the patient is at complete rest. It is a well-known clinical observation that a patient lying quietly in bed when mentally disturbed will have typical anginal seizures. The one mechanism which can be disturbed by such mental perturbation is the adrenal mechanism. Worry, anxiety, psychical disturbances of any type may produce a large discharge of adrenalin and it seems to us that this must play a rôle in the explanation of anginal pain as described above. Where total

thyroidectomy produces its effect we as yet have no explanation. It may produce it by interfering with the sensitivity of the vasomotor apparatus to adrenalin as already indicated by the studies of skin temperature following total thyroidectomy where we find greater vasodilator ability even in myxedematous people.

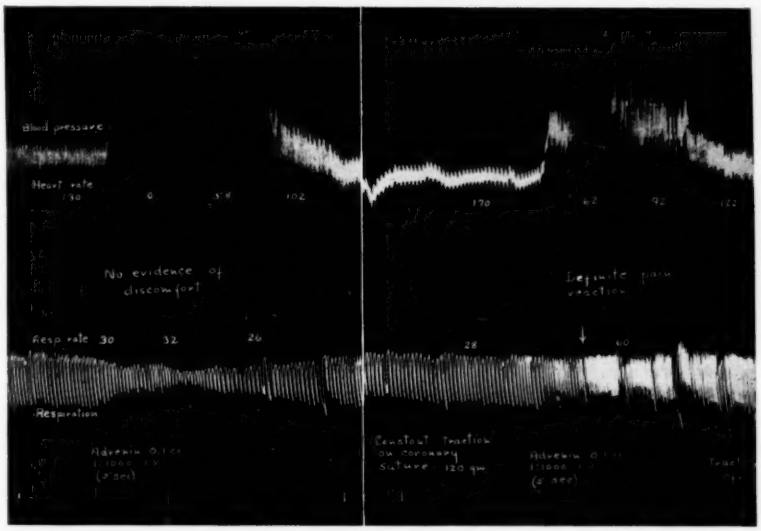

Fig. 13. Kymographic tracings of blood pressure and respiratory rate in animal (a) before and after adding adrenalin, and (b) before and after adding adrenalin with the addition of a constant traction of 120 gm. on the suture about the coronary vessel.

You will see that one cannot at this time make dogmatic statements concerning this method of therapy as applied to heart disease. From what has been presented, however, it seems definite that Blumgart's observations concerning the reciprocal relation of the speed of the circulation and the basal metabolic rate is substantiated and when intelligently applied does bring relief to patients with circulatory failure provided there is sufficient reserve available. The observations also tend to show there is an interrelationship between the adrenal gland and the thyroid gland which plays perhaps a major rôle in the symptom-complex of angina pectoris.

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CEREBRAL VASCULAR CRISES*

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UNTIL recent years it was almost invariably accepted, both by anatomists and physiologists, that there were four fundamental differences between the cerebral blood-vessels and those of the general circulation. These supposed differences were:

1. That many of the blood-vessels penetrating the brain substance were end arteries and did not anastomose.

2. That the pressure in the cerebral circulation was in direct relationship to that in the aorta and the general circulation.

3. That the cerebral arteries and veins were devoid of nerves and vasomotor control.

4. That cerebral arteries were not capable of vasoconstriction, dilatation, or vasomotor spasm as occurs throughout the general circulation.

Clinicians, however, were not in accord with this view, as frequently cerebral syndromes of a transient character manifested themselves which could not be logically explained on an organic basis. Similarly, neurosurgeons from their studies of certain types of epilepsy, both from clinical and operative evidence, were of the opinion that an intracerebral vascular reflex played some rôle in the underlying mechanism producing convulsions.

Pfeifer[5] and Cobb[2] have disproved the old theory of end arteries in the brain. They have demonstrated conclusively that the capillaries of the whole cerebral cortex communicate freely and that there is a general anastomosis between the blood-vessels of the surface and deeper structures of the brain.

Bayliss and Hill and other investigators came to the conclusion that changes in the caliber of the cerebral blood-vessels were determined by changes in the aortic pressure. They based their opinion on the assumption that the cerebral blood-vessels did not have vasomotor nerves or were ineffectual in acting as an independent regulating mechanism. Forbes and Wolff[4] demonstrated significant changes in the diameter of the pial arteries which seemed independent of the systemic blood pressure. Finesinger and Putnam[3] in their experiments on monkeys verified this independence of the vasomotor mechanism from the systemic aortic pressure. With a constant general arterial pressure they observed a definite decrease of cerebral blood volume on cervical sympathetic stimulation and a definite increase during vagus stimulation. Similar re-

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sults were noted with chemical stimulants. Intracarotid injections of epinephrine resulted in a decrease of cerebral blood volume, with a decrease in the diameter of the pial artery, while caffein or histamin injections produced a definite increase. They believe that the chemical mechanisms controlling cerebral flow are more powerful in causing changes than the vasomotor mechanisms. Huber[5] pointed out that there were nerves of two kinds on the pial blood-vessels: (1) medullated fibers which he considered sensory and (2) nonmedullated fibers which he considered vasomotor. In 1931 Penfield[7] finally demonstrated the continuation of these pial fibers on the cerebral blood-vessels throughout the central nervous system. However, no nerve fibers have been found on the capillaries, which Penfield believes is probably due to the difficulties in dissection and does not mean that such innervation does not exist. Forbes and Wolff[4] have found that the nerve supply of the cerebral vessels is derived from the sympathetic system and that stimulation of the vagus causes dilatation and stimulation of the sympathetic causes constriction of these blood-vessels.

These investigations have conclusively demonstrated that the cerebral vasomotor control is closely allied to the general circulation and that the cerebral blood-vessels are subject to similar dilatation, constriction, and vasomotor spasm as occurs in the general circulation. This is of great clinical significance as it explains many of the transient cerebral manifestations that present themselves in the course of constitutional diseases which may be associated with peripheral vasomotor instability.

The diseases in which cerebral vasomotor crises may manifest themselves are: cerebrospinal syphilis, cerebral arteriosclerosis, migraine, some types of epilepsy, Raynaud's disease, cerebral trauma, rarely cerebral neoplasms, angioneurotic edema, and allied disorders. Whether the transient paralysis occurring in uremic states is due to vascular crises or localized cerebral edema is still a moot question. It is very difficult to evaluate the relationship of symptoms to basic pathological disturbance in cerebral vascular spasm, as no evidence of this can be observed at autopsy. The clinical syndrome consists in transient attacks of aphasia, monoplegia, hemiplegia, or sensory disturbance lasting from one-half to twelve hours, with gradual complete restoration of function. However, there is a tendency to recurrence, either in the previously affected area or some other location. With the recurrence of these attacks and as the disease in the affected blood-vessels becomes more pronounced, thrombi may form, resulting in a permanent loss of function of the part involved.

Early recognition of the underlying cause may prevent these recurrent cerebral vascular crises and the resultant permanent disability. This is particularly true in cerebro-spinal syphilis. Spinal fluid studies frequently enable one to discover the etiologic factor and should be made in every case presenting this syndrome. The pupillary reflex changes may be an additional aid in arriving at a proper diagnosis.

In cerebral arteriosclerosis these transient attacks of paralysis occasionally occur as one of the earliest symptoms. Probably some of the epileptic seizures in this group are also on the basis of a vasomotor crisis. Although cerebral arteriosclerosis is a disease of the degenerative period of life, it may occur at any age. Barron[1] reported a case with postmortem findings in a child of thirteen. Schlosser reported a similar case in a child fifteen years old. The youngest patient in our series died at nineteen. A post-mortem examination revealed marked arteriosclerosis of the cerebral blood vessels, especially the Circle of Willis. In a fairly large percentage of these cases the blood pressure remains normal throughout the course of their illness. In Doctor Woltman's[9] series of 146 cases, 64.4 per cent had a mean pressure of 130 mm. systolic and 78 mm. diastolic. Frequently there is no demonstrable clinical evidence of peripheral or general arteriosclerosis. However the retinal blood-vessels manifest sclerotic changes in about one-fifth the cases, which is conclusive evidence of an associated cerebral arteriosclerosis. The spinal fluid is normal. Because of these many negative findings a correct diagnosis is often most difficult and can only be determined by prolonged observation and the development of additional symptoms, such as vertigo, personality changes, evidence of spinal cord involvement, and so forth. In spite of the intrinsically progressive character of the disease the degenerative process may often be indefinitely delayed by general reconstructive and hygienic measures, a carefully regulated life, and avoidance of worry and undue fatigue. Osler[6] reports a case in whom repeated

transient attacks of mutism, hemianesthesia, and diplopia occurred on the basis of a cerebral arteriosclerosis and hypertension. Under a careful and restricted regime the patient continued a fairly active life for over eleven years.

In migraine, Raynaud's disease, and the other disorders, the diagnosis can usually be made from the history of the case, the associated symptoms, and the negative sero-biological findings. The following cases are illustrative:

Case 1.—Cerebro-spinal syphilis, with attacks of aphasia and monoplegia developing during the early stage of constitutional syphilis and while under treatment for lues.

A male, aged twenty-two, was referred to our neurological service at the Ancker Hospital by Dr. H. E. Michelson, Minneapolis.

The family and personal histories were negative. Two months previous the patient had developed a "cold sore" on his upper lip which would not heal. Some time later he developed a generalized rash and a sore throat. He reported to the Minneapolis Dispensary. Examination revealed a chancre of the lip, constitutional manifestations of syphilis, and a positive blood Wassermann. He was given the usual antiluetic treatment. During the course of his treatment he suddenly developed an attack of aphasia of several hours' duration. Because he was a St. Paul resident he was referred to the Ancker Hospital.

At the time of admission he appeared perfectly well. His speech was normal, his blood Wassermann had become negative, his spinal fluid was under increased pressure, and showed a cell count of eighteen, a positive globulin, a positive Wassermann, and a syphilitic colloidal gold curve. The neurological examination, including the pupils, was negative throughout.

On the third day at the hospital he had another attack of aphasia of about five hours' duration, which gradually subsided. A few days later he developed a paralysis of the right arm which gradually subsided during the course of twelve hours. Four days later he had a similar attack of about eight hours' duration. The monoplegia was localized to the right arm. The right leg did not become involved, and his speech remained normal. He was placed on prolonged intensive antiluetic treatment with repeated spinal drainage. He made a satisfactory recovery and there were no further clinical manifestations of cerebral vascular spasms.

Comment.—The cerebral vascular crises which caused his aphasia and monoplegia occurred during the early stage of syphilis and in spite of active antiluetic treatment. This early manifestation of central nervous involvement is quite unusual during the secondary period of syphilis. It occurs more frequently in the later stages when cerebro-spinal syphilis is more prevalent and the vascular and degenerative changes more pronounced.

Case 2.—Cerebro-spinal arteriosclerosis with brief attacks of monoplegia, hemiparesis, aphasia, and hemianesthesia, finally terminating in a permanent right hemiplegia with aphasia.

A woman, aged sixty-two, right-handed, was seen in consultation with Dr. W. R. McCarthy, May 27, 1925.

The family and personal histories were essentially negative. At the age of fifty-one she passed through her climacteric without any undue manifestations. At the age of fifty-seven while eating breakfast she developed a weakness of the left side of her face, including the tongue, left arm, and leg. She was not aphasic, but her speech was thick. Within ten minutes the weakness had disappeared. About four hours later she had a recurrence of her paralysis which continued for about thirty minutes and ended in recovery. She remained well for one week, but during the following three days had seven similar attacks, of from ten to forty minutes' duration, involving the entire left side. All symptoms subsided except for easy fatigability until two years later when quite suddenly she developed a right hemianopsia of two hours' duration, which gradually subsided. Six months later while in bed her right arm suddenly became numb and she was unable to determine its position without locating it with her left hand. This subsided after several hours. She remained quite well except for some numbness and "strange feelings of burning and prickling" in both lower extremities. She gradually became somewhat emotional and had occasional crying spells. About two years later she developed a complete right hemiplegia with aphasia, and gradually developed a coarse tremor of the head and right arm. An examination at this time revealed a well nourished woman presenting the usual findings of a right hemiplegia with increased reflexes and a positive Babinski on the right side. She appeared somewhat emotional. The retinal blood-vessels were definitely sclerotic. There was a constant, fine tremor of the head, and irregular jerky movements of the right arm. The peripheral blood-vessels did not present any definite evidence of a general arteriosclerosis, and the heart sounds were normal. The hemoglobin was 82 per cent; blood pressure, systolic 165, diastolic 80; urine, normal. The blood Wassermann and spinal fluid were negative. She progressively grew worse.

Comment.—This patient presents a clinical syndrome of cerebro-spinal arteriosclerosis with recurrent attacks of cerebral vasomotor crises with a terminal hemiplegia secondary to thrombosis.

Case 3.—Migraine with transient attacks of hemianopsia, alexia, monoplegia, and monoanesthesia.

A man, aged twenty-six, right-handed, was seen in consultation with Dr. H. T. Nippert, May 28, 1926. His family history revealed that the mother, aged seventy, had had typical attacks of migraine for forty years,

recurring every four to eight weeks, and of six to forty-eight hours' duration. One brother and one sister have severe migraine headaches, and two brothers died of cerebro-spinal syphilis. Two brothers and one sister are well.

The personal history is essentially negative. He uses tobacco and alcohol moderately, denies venereal disease, has a duodenal ulcer and has been on an ulcer diet for eighteen months.

Since the age of three years he has been subject to severe headaches, from three to six a year. The headache would begin with a burning pain behind the eyeballs and gradually extend over one-half of his head (right or left) to the occipital region. It would increase in intensity, was associated with nausea, and would necessitate his going to bed. The headache continued for several hours, and after a night's sleep it would subside. There were no ocular or visual disturbances for twenty-one years.

At the age of twenty-five, after a heavy luncheon and while walking to his office, he developed a right hemianopsia. This continued for about four hours, then he gradually developed a severe unilateral headache, became nauseated, and had emesis. After a night's sleep he awakened and all symptoms had subsided. He had a similar attack of about six hours' duration three months later which was accompanied by numbness and tingling sensations of the right arm.

About six months later, April 24, 1926, he suddenly developed a hemianopsia. This was associated with vertigo, inability to remember the names of his office employees, a slight aphasia, and numbness and ataxia of his right arm. Gradually a severe headache developed. This attack was of about eight hours' duration, after which he entirely recovered.

One week later while writing, his right hand developed numbness and "tingling" sensations; he was unable to grasp the pencil, which fell out of his hand. This continued for an hour, after which he had a similar experience in his left arm, and soon after a severe headache developed. All symptoms gradually subsided as the headache disappeared. In another attack he was able to speak and understand spoken words correctly, but he could not interpret what he read. During one attack he had hemianopsia with a right hemianesthesia. During the months of April and May, 1926, he had several attacks as described above, of variable intensity and from two to eight hours in duration.

The physical and neurological examinations made on May 28 were normal throughout. Dr. H. Rothschild reported that the fields of vision for form and color, and the fundi and retinal blood-vessels were negative.

Studies of the blood, including a Wassermann test, urine, spinal fluid, and spinal fluid pressure were normal. A roentgenogram of the skull was negative. Blood pressure was: Systolic 128, diastolic 80.

He was placed on phenobarbital and calcium lactate. His activities were somewhat restricted, and he definitely improved for four months. On October 10, 1926, he had a recurrence of his migraine with hemianopsia and aphasia. His progress has been quite satisfactory under the regime outlined, his attacks of headache have become less frequent, and the associated symptoms less pronounced. He observed that a large dose of milk of magnesia taken during the prodromal stage would occasionally lessen or abort the attack.

Comment.—It is not uncommon to note a contraction of the retinal blood-vessels during an attack of migraine, and this may have been the basis of his hemianopsia. However, it may have been due to a vasomotor crises of one of the branches of the occipital artery. The aphasia, alexia, and other sensory and motor manifestations are probably on a similar basis, due to a transient spasm of some of the other cerebral blood-vessels.

Case 4.—Raynaud's disease with repeated attacks of blurred vision in the right eye, one transient attack of aphasia with numbness of tongue and right face, transient attacks of monoplegia, right arm, left arm, and left leg, and finally permanent left hemiplegia.

This is the case of a physician, aged fifty, right-handed, practicing in North Dakota.

His father died at the age of fifty-four of a cerebral hemorrhage. His mother died of cardio-renal disease at seventy-four. One brother and one sister are living and well.

His past history is negative. He uses tobacco and alcohol moderately.

Present complaint began about 1914 with occasional blanching of the little finger of the right hand during severe cold weather. No further disturbance was noted until the winter of 1919-20 when repeated typical attacks of Raynaud's disease occurred in all the fingers of both hands. There were no attacks during the summer months. This condition gradually became more pronounced each winter and was accompanied by severe burning pain. In the winter of 1923-24 the toes of both feet became similarly involved. The attacks gradually increased in frequency and severity until the winter of 1927, when he had to retire and move to Florida. In the warm climate the attacks still occurred but were less pronounced.

Examination made in November, 1926, revealed no physical or neurological abnormalities except a slight bluish tinge of the finger tips. All laboratory findings were normal. An examination on November 5, 1929, gave similar findings. During the winter of 1927-28 he would have attacks of blurred vision in his right eye, as if he were looking through ground glass. These attacks were of several hours' duration and occurred at irregular intervals. He estimated that he had about twenty attacks of blurred vision during that winter. The fundi, retinal blood vessels, and the fields of vision were normal at our examination in November, 1929.

In March, 1930, he had his first attack of transient hemiplegia. This began suddenly with numbness, tingling, and weakness of the left arm and left leg, and was accompanied by blurred vision in the right eye. This condition continued for about two hours, then gradually subsided to complete return to normal function. About

three weeks later he had a similar involvement of the right upper extremity of about one hour's duration, with recovery. He again consulted us on May 5, 1930, when all examinations and laboratory findings were normal. On May 10, 1930, while in North Dakota on a cold, rainy day he had another transient hemiplegic attack similar to the one in March.

On May 29, 1930, he suddenly became aphasic, and developed a numbness of the tongue and right half of the face. This continued for about one-half hour and then subsided. The summer of 1930 was exceedingly hot in North Dakota and he was free from all attacks until October. During that month he had several attacks in his hands and feet. On November 1 he developed a marked left hemiplegia of twelve hours' duration with gradual complete recovery except that he noted a left ankle clonus with slight weakness of the left leg for about three weeks. He spent a comfortable winter in Florida, and the warm summer of 1931 in North Dakota and the following winter in Florida were uneventful. We examined him on August 19, 1931, without eliciting any pathologic findings.

On August 4, 1932, he developed a sudden weakness of the left arm, left leg and the right arm. The right arm gradually recovered, and the left hemiplegia improved until August 16, when the left hemiplegia became aggravated. We examined him on August 20 when he presented a marked paralysis of the left arm and leg with the usual pathologic reflex changes. This condition has continued with slight improvement to date.

During his entire period of observation from 1926 to September, 1932, repeated laboratory examinations of the urine, blood, and spinal fluid were normal. His blood pressure varied between, systolic 120, diastolic 72, and systolic 106, diastolic 65. Since the hemiplegia has become permanent the vasomotor attacks in his extremities have definitely improved, probably due to his restricted activities and protected environment.

Comment.—This patient developed attacks of vasomotor spasm of his peripheral arteries, gradually involving some of the retinal arteries, and then the cerebral circulation in various regions, to ultimate thrombosis. All of these attacks were evidently on the basis of his Raynaud's Disease.

Case 5.—Undiagnosed case of probable cerebral neoplasm, of transient attacks of monoplegia, upper or lower, limited to left side, one attack of left facial paralysis and dysphagia, two brief periods of unconsciousness.

This patient, a male, right-handed, aged forty-six, consulted us on August 20, 1934.

His family and personal histories were negative except that he smokes excessively, does not use alcohol, and denies venereal disease.

In September, 1933, he developed a paralysis of his left face (central type) associated with "thick speech," difficulty in swallowing, and numbness of the left arm. This condition gradually subsided in forty-eight hours. He remained well until June 16, 1934, when while lying in bed he had a complete paralysis of his left leg, which was of one-half hour's duration. A few days later he had a similar involvement of his left arm. Since then he has had at least fourteen similar attacks limited to either the arm or the leg and of varying duration of three to thirty minutes. In the interval he felt perfectly well. On August 18 he had a short fainting spell with paralysis of the entire left side. The attack was of about five minutes' duration. He recovered completely. Two days later while sitting in a chair he suddenly slumped over to the left and his left arm hung limp. This attack lasted about five minutes. We examined him that afternoon. During his entire illness there were no headaches, nausea, vomiting, vertigo, or visual disturbances. Mentally, he is alert. His bladder and sexual functions are normal.

The physical and neurological examinations were negative throughout except for a very slight weakness of the left facial muscles. Both pupils, fundi, visual fields, other cranial nerves, reflexes, sensation, and so forth, were normal. His hemoglobin was 83 per cent; blood pressure, systolic 155, diastolic 90; urine, normal. Blood Wassermann and Kahn reactions were negative. The spinal fluid was under increased pressure, 20 mm. of mercury, with no evidence of bloc on jugular compression. The spinal fluid was clear, contained six cells, a trace of globulin, gave a negative Wassermann, and a negative colloidal gold curve, and showed a quantitative protein of 10 mg. per 100 c.c. X-ray of the skull was normal. An encephalogram was advised but refused. He was placed on phenobarbital and iodides. He has been free from attacks since August 20, and is still under observation.

Comment.—The only abnormal finding in this case was the increased spinal fluid pressure. Because of this it is our opinion that he probably has a slowly developing neoplasm located over the right Rolandic area and that the attacks are either due to cortical irritation or localized vascular crises. However, one cannot exclude an early cerebral arteriosclerosis. Further development of symptoms or encephalographic studies will enable one to arrive at a definite diagnosis. This case illustrates the difficult diagnostic problems one encounters in this type of a syndrome.

Summary

1. A brief review is given of the recent investigations made on vasomotor nerve supply and vasomotor control of the cerebral blood-vessels.

2. It has been definitely shown that cerebral blood-vessels have a nerve supply similar to that

of the general circulation and are subject to dilatation, contraction, and vasomotor spasm.

3. Clinical cases illustrating these various disorders are reported.

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THE AMBULANT TREATMENT OF HERNIA*

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SO much has been written on the subject of hernia that it seems as though the last word has been said. Yet when an analysis is made of statistics as to cure, there is a difference in results that vary anywhere from 1 to 20 per cent. A recent article by Bissel and Andrews states that the results in operations on direct hernias are so bad as to constitute a major surgical scandal, and further states that when one considers that the recurrences are far more dangerous than the original hernias, it seems high time that the subject was thoroughly reconsidered. Interest has been manifested at various times in regard to the ambulant treatment of hernia, but it has never become popular. As early as 1880, Billroth made the statement that if anyone could obtain a solution that would cause the artificial proliferation of tissue, the radical operations for hernia would be obviated. It is my object here to present opinions and impressions with results to date, gained from experience with the ambulant treatment of hernia, during the past three years.

We used various solutions in experimental work on dogs and rabbits, as well as in practical application to patients. Before treating any patients, colored novocain solution was used to inject the internal inguinal ring, and it was surprising to note how this solution could be deposited around the internal inguinal ring with the technic to be described. The first solution that was used consisted of Phenol 50 parts, Alcohol 25 parts, Lloyds Specific Tincture of Thuja 25 parts. This should stand for at least forty-eight hours and then either be decanted or filtered. Pina Mestre solutions were used. Injection of rabbits with Pina Mestre solution put up by a drug firm according to the formula, produced necrosis and was not used clinically. With the original Pina Mestre solution there was a marked proliferation of tissue with foreign body giant cells. Then a solution consisting of a distillate of the tinctures of several botanical herbs was used. To this was added .1 per cent tannic acid and .5 per cent thymol. This was the original Proliferol, which has since been modified at my suggestion. This produced a picture which could not be distinguished from the area injected with the Pina Mestre solution. A number of dogs were injected using Fluidextract Pinus Canadensis in alcohol and phenol, in strengths of 1, 3 and 10 per cent. These are the basic drugs in Mayer's solution. These produced necrosis, abscess, and, in one dog, peritonitis and death. Pina Mestre solution consists of a group of tinctures which do not have a standardized strength of tannic acid, two of the drugs not belonging to the United States Pharmacopœia. Several

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different strengths of a tannic acid preparation were used, the strength varying from 0.5 per cent up to 5 per cent. On account of the burning that results from the injection of a tannic acid preparation, various local anesthetics, novocain, nupercain and benzyl alcohol were used. This did away with the burning pain, but a large percentage of these patients would have symptoms of an acute coryza on the following day. This did not occur in all cases, but did in so many that it had to be discontinued. This was thought to be due to the fact that it did not exist in colloidal form in the synthetic preparation and was more rapidly absorbed, thus causing toxic symptoms.

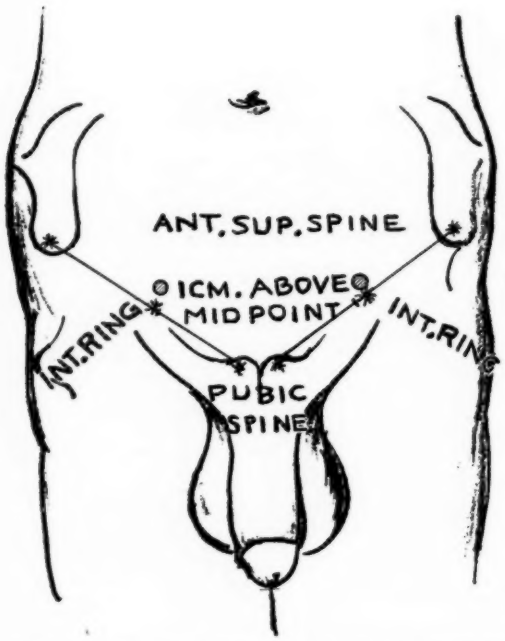

Fig. 1. Sketch showing the location of the internal inguinal ring, which is approximately 1 cm. above the midpoint between the anterior superior spine of the ilium and the spine of the pubis. This varies according to the size of the hernia, so that in a very large inguinal hernia where the defect in the transversalis fascia is greater, the ring will extend lower. This location is above the line between the two spines and not along the line.

Microscopic report of specimens after injection shows a marked proliferation of fibroblasts with these dipping down between the muscle fibres. This, according to Dr. Bell, produces a binding effect, as he expressed it. There was no infiltration of polymorphonuclear cells or any evidence of necrosis, except in the rabbits injected with Pina Mestre solution put up according to formula by a pharmacist. Here fifteen minims was injected at weekly intervals and at the end of six weeks there was necrosis present with marked infiltration of polymorphonuclear cells and lymphocytes. No giant cells were found. Sections where a tannic acid preparation was used showed a denser fibrosis than sections with the Thuja mixture. Injection close to the peritoneum or just within the peritoneal cavity showed no evidence of abscess or necrosis, but a similar picture. The omentum was adherent to the abdominal wall, and there was so much proliferation of fibrous tissue as to completely obliterate the peritoneum. Results of injection below the fascia of dogs and rabbits showed a marked proliferation of fascia fibres with no evidence of necrosis. There was no necrosis or infiltration of polymorphonuclear cells. Injection into the peritoneal cavity shows no evidence of abscess, but a similar picture. The omentum was adherent to the abdominal wall, and several loops of intestine were matted together. There was no evidence of necrosis present. Sections from dogs injected with the original Pina Mes-

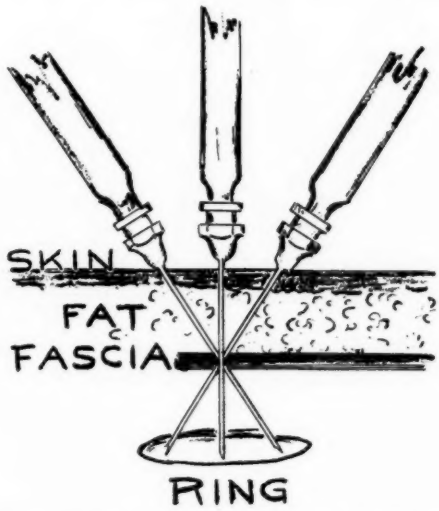

Fig. 2. Sketch showing the injection of the internal inguinal ring. The needle is introduced directly through the skin, fat and fascia of the external oblique muscle. As the needle penetrates the fascia, there is a distinct "give" feeling. Very little experience is needed to determine this location. As the needle is introduced slightly further, depending upon the thickness of the abdominal wall, it will approach the region of the internal inguinal ring. When the needle is in the proper location, the syringe can be rotated in a circle, thus giving free rotation of the tip of the needle. This can be very easily demonstrated by the injection of colored novocain solution, preparatory to operating upon a hernia.

tre, as well as the distillate of the drugs contained in the formula, showed a reaction which could hardly be differentiated one from the other except that the section from the original Pina

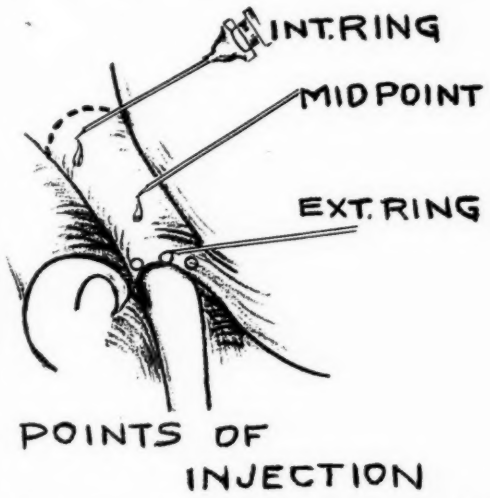

Fig. 3. Sketch showing various points for the injection along the inguinal canal. The solution should always be deposited below the fascia and not superficial to the fascia. Several points should be injected, as per sketch, at the external ring. The needle point should be within the external ring so that none of the solution filtrates into the subcutaneous fat, as, when this happens, there will be a hard nodule present. The needle should not go so deep as to injure the cord.

Mestre solution showed better developed foreign body giant cells. There was no infiltration of P.M.N. cells or necrosis in these specimens.

There are several contraindications to this method. All types of hernias are not amenable to this type of treatment. Postoperative or incisional hernias usually have adhesions or incarcerated abdominal viscera and no definite sac and should not, as a rule, be so treated. Incisional hernias usually have one hernia that can be diagnosed, but have several potential hernias along the line of the incision. When there has been a very small incision, a definite opening can be determined, and the contents can be reduced and held reduced by a properly fitting truss. This hernia can be so treated.

Hernia associated with an undescended testicle, incarcerated or irreducible hernias should not be injected on account of the danger of strangulation. These are distinct surgical conditions. Hernias that can be reduced, but where the symptoms cannot be completely relieved by proper application of a truss, are surgical. Sliding hernias should not be treated by injection. It is very doubtful whether a sliding hernia can be held reduced by a truss. To begin with, I was skeptical about treating direct hernias, but it seems as though the results of injection in direct hernias are just as good as in the indirect inguinal type. Any general surgical contraindication, such as hyperthyroidism and hemophilia, should always be considered a contraindication. Laying aside the contraindications we may state that any inguinal hernia can be treated provided it is reducible and can be held reduced by a properly fitting truss, and provided there are no surgical contraindications, as mentioned above. Although a few femoral hernias have been treated with good results, I believe that, especially in large hernias, complications are liable to occur. Several epigastric hernias have been treated with good results. At the outset no umbilical hernias were treated, but, with improved truss pads, it was found they can be treated.

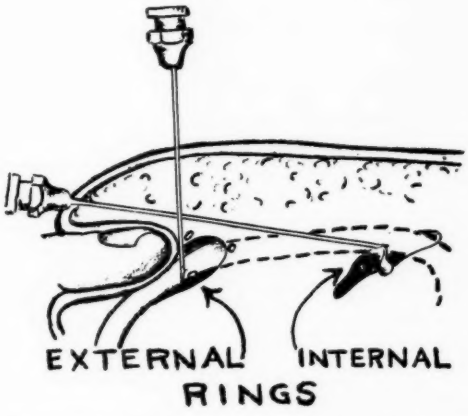

Fig. 4. The internal ring can also be injected by introducing a 3 inch needle through the external ring, and passing it forward along the inguinal canal to the region of the internal inguinal ring. After passing the external ring it is carried forward to about 1½ to 1⅝ inches. There is, however, more danger of injuring the cord with this technic.

Femoral Hernias

Femoral hernias can be injected very easily by placing the tip of the finger in the femoral canal, and then injecting the solution immediately below the tip of the finger. Not over two or three drops should be injected at one time in femoral hernias. As a rule not over three or four injections are necessary to obliterate a femoral hernia.

To begin this work, it is absolutely necessary to know how to fit a truss so as to hold the hernia reduced. The pad of the truss should fit over the inguinal ring so as to hold the hernial contents within the abdomen. One type of truss will not fit all individuals. The best truss that I have yet found is a spring type. When properly

fitted, the patient can engage in almost any form of exercise or work he desires. Trusses are usually fitted low, and very often give relief, but when so fitted they do not hold the hernia reduced except in direct hernias. If improperly fitted they cause the hernial contents to press outward against the fascia of the external oblique and result in a fraying or thinning out of the fascia as well as an enlargement of the defect in the transversalis fascia. The spring type of truss is not always suitable for a patient with the rounded or feminine type of hips. Here an ordinary elastic type of truss is satisfactory. The requirements are that the truss stay where it is put, keep the hernia retained by a constant firm and continuous pressure and prevent protrusion of any abdominal contents. It is necessary to watch patients regularly to see that the truss fits, as a perfect fitting truss today may be worthless if a patient loses any great amount of weight. The measurement for the spring type of truss is taken about 2 cm. below the crest of the ilium and bringing the end of the tape down to the symphysis pubis. Coöperation on the part of the patient in wearing a truss is absolutely essential; otherwise failure is the result. Several patients have been successfully fitted with a truss, and treated only after having the patient on a reducing diet and thus reducing the intra-abdominal pressure. Large scrotal hernias can often be held reduced after having a patient in bed for several days with the foot of the bed elevated, and then treating the patient daily for three days to a week. For umbilical hernias, the best form of a truss is a hard pad which fits into the depression and is held in place with an elastic binder wrapped around the body several times. This is a definite improvement over any previous truss or binder used for this type of hernia.

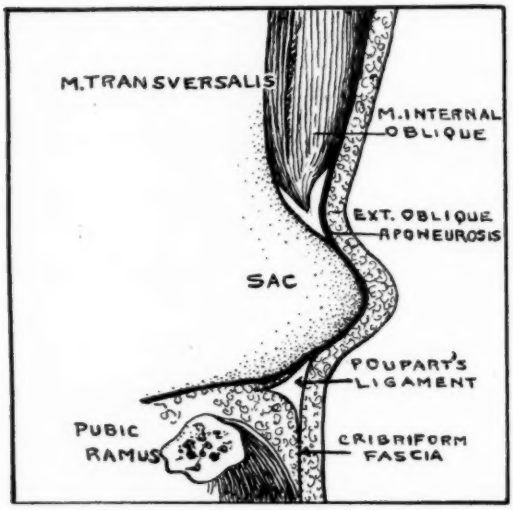

Fig. 5. Sections showing pathologic changes due to a direct hernia. This is not a true hernia in the true sense of the word, but a weakness of the abdominal wall in the inguinal region. It is impossible to get a strangulation of a hernia of this type.

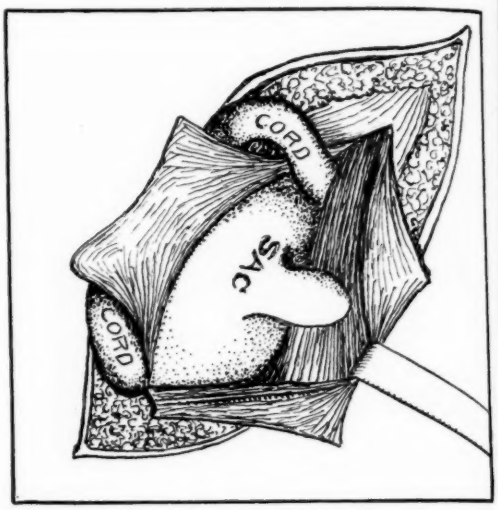

Fig. 6. Diverticulum in a direct hernia shows the sac pushing through the weakened abdominal wall in Hesselbach's triangle. This is the type of hernia which will strangulate.

The objections which have been mentioned to injection treatment should be considered. Paraffin injections can be dismissed without further discussion, for it is a well established fact that the method has resulted in very few permanent cures. It causes irritation from the presence of a foreign body and generally requires surgical interference for its removal and the closure of the hernia. The fact that it has been only in the hands of quacks is not a good argument, for it is not so many years ago that reputable medical men were severely criticized for the injection of hemorrhoids or varicose veins, procedures which today are accepted. The so-called Timmerman treatment with alcohol injection should be dis-

carded on account of the large number of injections required, and the numerous resulting complications. The claim that irritating solutions cause discomfort and pain sufficient to cause patients to be incapacitated, has not been substantiated. It is true that some patients will have a greater reaction than others, but very few suffer sufficiently to incapacitate them from heavy work. Another objection is that a truss must be worn for a long period of time. A properly fitting truss is of no more inconvenience, after the first few days, than a well fitting glove. I think it can be safely stated that 80 per cent of all individuals suffering from hernia are wearing trusses at the present time, and that only one out of ten trusses holds the hernia reduced. It has been stated that injection is a blind and not a rational procedure. To this I may reply that there is a definite technic and, unless this is learned, great harm may result.

A number of complications attending injections such as hydrocele, epididymitis, sepsis, strangulation, sterility, peritonitis and abscess have been mentioned. There has been swelling of the cord in a few cases, and this has usually occurred toward the end of the treatment, but has caused no serious disability. Only rarely can fluid be aspirated from a hydrocele of the cord, but this will be absorbed and is not serious. Only an occasional patient will suffer sufficient reaction to incapacitate him, and this usually lasts only one or two days. There has been no atrophy of the testicles noted to date. Whether this may prove a later complication and result in sterility cannot be determined until after a lapse of years. It is surprising how many cases of atrophy of one or both testicles were found among these patients when first examined.

I wish to mention two patients who had hydroceles with their hernias. At the beginning of treatment, the fluid would gravitate into the abdomen when lying down. Both these patients had a 50 per cent atrophy of the testicles when first seen. After treatment, there was no recurrence of the hydrocele and one of these patients, when last seen, showed a testicle 75 per cent the normal size. Another argument is that as a result of injection there is not a strong abdominal wall. A number of treated patients have developed hernias on the healthy side after cure was effected on the diseased side. The time elapsed since commencing this treatment is however too short as yet to warrant any final conclusions on this point. One patient who was treated and

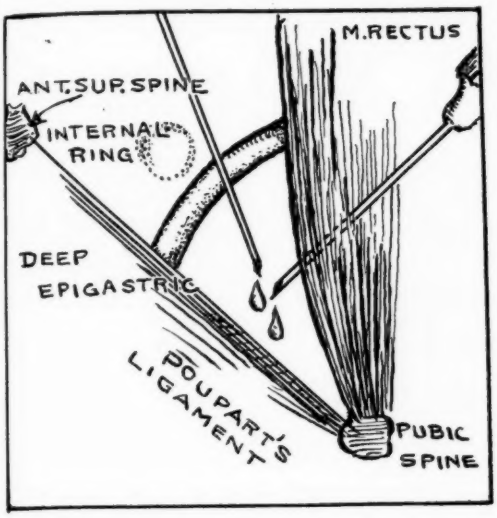

Fig. 7. The technic for the injection of Hesselbach's triangle. In the case of direct hernias the needle can be slid along the outer edge of the rectus abdominis muscle or can be entered into the triangle lateral to the rectus abdominis from above. In this manner the triangle can be injected without injury to the cord.

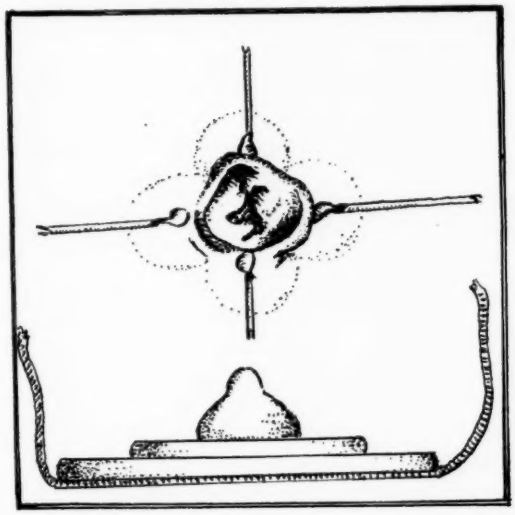

Fig. 8. Method of injection of umbilical hernias. Novocain should first be used as injected in inguinal hernias, only in a smaller quantity. Not over 1 to 1.5 c.c. should be injected at a time at various sides of the hernia. The needle should reach down to the edge of the fascia.

Cross section of an umbilical pad showing cone shaped truss pad which fits into the hernia opening and then two pads which support this. After this pad is put in place, it is held in place by an elastic bandage wrapped around the abdomen several times.

died about a year later of an attack of influenza, at autopsy showed a perfect closure of the internal ring and a finger could not be forced through this region.

Fraser and Hall, at Bellevue Hospital and New York University, injected a few hernia cases in 1929, and carried out experimental work on monkeys and dogs. For this they used the Pina Mestre solution. Their results showed a swelling and edema in ten days. Examination of the indurated areas showed a vigorous proliferation of endothelial and connective tissue cells, plus large mononuclear phagocytes and foreign body giant cells. Two specimens showed a trace of the injected substance in the abdominal muscle of the monkey and the omentum of the dog. Two sections of the tissues from the monkey showed an extensive mechanical rupture and necrosis of the muscle fibres. There were masses of yellow granules engulfed by large multinuclear giant cells. Marked proliferation of fibroblasts with some lymphocytes and plasma cells was also shown. There were a few areas of multinucleated regenerating muscle cells and single myelocytes. The omentum showed reddish granules and multinucleated giant cells, some single reticular cells and marked proliferation of fibroblasts.

In patients treated by injection an induration in the region of the injection follows. This is usually tender to pressure on the day following treatment. Hot packs relieve the pain when present. In very few cases was this of such severity as to incapacitate the patient. Usually after two to four treatments there is sufficient exudate or plastic tissue formation to prevent protrusion of the viscera. The external ring shrinks in size and the fascia can be felt to thicken, so that at the end of a few weeks the external ring will not admit the tip of the index finger. This usually begins after two injections at the external ring. There has been no infection in any case. When a tannic acid mixture was used the patients would occasionally complain of general malaise or a feeling as though they had a cold, on the following day. Practically all patients mention the great relief obtained as soon as they are fitted with a truss and have had two or three treatments. There is less soreness and pain from the distillate Proliferol or from the original Pina Mestre solution, and these seem to give quicker results than any of the other solutions. The technic is different than with the other solutions.

There are several advantages to this form of treatment, the principal one being that it is ambulatory and that the patient continues working, is not confined to the hospital for a period of two weeks, and is not incapacitated for another period of four to eight weeks. There is no question but that the economical issue is of great importance at the present time. There is no question but that the recurrence of hernia following operation is much greater than statistics show, for hernias will recur as long as fifteen to eighteen years after the operation, and it is most difficult to obtain an accurate check of recurrences. I do not believe that the recurrences will be as high following this type of treatment as it is following operation, and especially if the patients are watched every two months for a period of two years. A number of postoperative patients who began to show weakening and a beginning recurrence, were fitted with trusses and treated, and a recurrence of the hernia was prevented. I believe that the recurrence of hernia following operation can be practically done away with, provided the patients are fitted with a truss and compelled to wear it for a period of time after operation.

The technic is not difficult when the anatomy of the parts is known. After the patient has been fitted with a truss, and this has been worn for a period of several days to several weeks so as to be certain that it fits and holds the hernial contents reduced, treatment can be started.

The formulas for solutions which we have been using to date are as follows:

Thuja Mixture

Phenol	50 parts
Alcohol	25 parts
Lloyds Specific Tincture of Thuja	25 parts

Allow to stand two days and then either decant or filter.

Zinc Sulphate Solution

Zinc Sulphate	1 dr.
Phenol Crystals	6 dr.
Glycerin	4 fl. dr.
Aq. Cinnamomi	1 fl. oz.
Fld. Extr. Pinus Canadensis (dark)	5 fl. dr.
Sterilized chemically pure redistilled water	2 fl. oz.

Dissolve the zinc sulphate in the cinnamon water. Liquefy the phenol crystals by heating. Add the

glycerin. Shake thoroughly until mixed and cooled; then add the distilled water and finally the fluid extract of pinus canadensis. Shake thoroughly. Allow the fluid to stand for about a week, agitating the mixture several times a day. Subsequently it should be filtered. Before injecting, boil the solution in a glass tube.

Pina Mestre solution consists of several vegetable tinctures, the basic drug being tannic acid.

Proliferol solution consists of a distillate from the tinctures of several botanical herbs to which is added thymol, tannic acid and benzyl alcohol.

When using the Thuja mixture or Mayers solution, two to five drops are injected at the internal ring as described in the accompanying sketch. Injections are made about twice a week, depending upon the reaction of the individual. Should there be much reaction then the periods between the injections are lengthened. After several injections in the internal ring there is usually sufficient plastic exudate to prevent herniation, even when the truss is removed. After beginning treatment the patients are advised to wear the truss day and night for at least thirty days, or until such time as we are certain that there is sufficient organization to hold the hernial contents within the abdomen. Injections are also given at several points along the hernia canal, just beneath the fascia. Injections are also given just inside the external ring and also in Hesselbach's triangle. For the injection of Hesselbach's triangle, the needle is introduced mesial to and posterior to the cord, depositing the solution upon the conjoined tendon or the transversalis fascia.

The type of syringe most satisfactory is the ordinary insulin or tuberculin syringe with a twenty-two gauge needle. For the Pina Mestre solution a 5 c.c. syringe is the best.

Usually up to eight drops of the Thuja solution can be injected, whereas two to six drops of the Zinc Sulphate solution is usually sufficient. The number of injections required to close the hernia varies. A few patients have received only four treatments, and have obtained good result. As many as twenty injections have been given to cases of large scrotal hernia. It is much better to give more than the minimal number of treatments and be sure of a good closure.

With the Pina Mestre solution or the distillate (so-called Proliferol), the treatment is started at the external ring. First a site on the mesial side of the external ring is injected. Then injections are given on the lateral border of the external ring, after which two injections are given in the lateral and mesial borders of the internal inguinal ring. Then several injections are given along the course of the inguinal canal. Two c.c. of 2 per cent novocain solution without adrenalin is first injected just below the external oblique fascia. The needle is then left in situ and after three to five minutes the injection of the solution is made. A quantity of 3 to 5 c.c. can be injected at a time. It is preferable to treat these patients every other day or twice weekly, although they can be treated daily with good results. There is much less after-pain or soreness with these solutions than with the other solutions. The treatment should be continued until the entire inguinal canal is filled with a plastic exudate which becomes indurated and hard, and until no impulse on coughing is present. It is not advisable to have the patient strain and cough until it is fairly certain that the hernia is obliterated. Occasionally there will be swelling of the cord, but this does not contraindicate treatment at that time. The swelling always subsides in a few weeks. In direct hernias the region of the internal inguinal ring should be injected to guard against development of an indirect hernia.

At the time of our most recent check there have been under treatment 406 hernias in 387 patients. A very small number of these have been only fitted with trusses because of their advanced age or feebleness. The recurrences to date run a little less than 4 per cent. This includes indirect inguinal, direct inguinal femoral and epigastric types. There has been difficulty in closing the hernia in a few instances, but in only three cases have we been unable to effect a complete closure. These were cases in which there was extreme difficulty in holding the hernias reduced that were injected against our first advice. One case was that of a man who was referred for operation. He had developed a direct hernia after the closure of an indirect inguinal hernia. In this case we did not diagnose the direct hernia.

The following instructions are given to every patient:

1. The truss should be worn next to the body, removed in bed, and put on in bed.

2. All patients should wear their truss night and day for a month after treatment is finished.

3. If the truss does not stay in position, a strap fastened in front and back will hold it in place.

4. The pressure of the pad should produce a depression in the skin.

5. If the hernia becomes painful or if you are distressed by wearing the truss, report to the clinic for examination.

6. The hernia must be held back at all times by the truss.

7. You will be able to continue your regular occupation, but if you do any heavy lifting, see that the truss is in proper position.

8. The number of injections varies from eight to sixteen.

9. The truss should be worn six months after the last injection.

10. At the end of this period return for check-up.

11. It is also well that you report for examination every two months for about two years.

12. If at any time a recurrence develops, we would appreciate it if you would return for examination, or notify us to that effect.

Conclusions

1. Injection is a safe and effective method of eradicating certain types of hernias, if proper technic is used, but there is danger of complications if details are not adhered to.

2. It demands the coöperation of the patient in the proper wearing of the truss.

3. Knowledge of the fitting of trusses and the technic of the injection is absolutely essential.

4. Recurrence of hernia can very nearly be done away with by combined form of treatment.

5. Patients who are incapacitated and have a definite surgical contraindication can be so much relieved as to enable them to pursue a gainful occupation, and in many cases a cure can be effected.

6. Complications as mentioned above have not been encountered to date in clinical cases.

7. This treatment brings the mechanical treatment of hernias, where necessary, from the hands of those who know little or nothing of diagnosis, pathology and anatomy, into the hands of physicians who should know this form of treatment.

Discussion

DR. JAMES C. MASSON, Rochester, Minn.: I am sure that we have all been much interested in Dr. Bratrud's presentation of this subject. I think he should be congratulated for bringing before the medical profession a method which, although known for a long time, has been done satisfactorily by only a few men.

There is no doubt in my mind that the most important element in this type of treatment is proper training. We all know the difficulties some men, even those who are doing a good deal of surgery, have in attempting to put a needle into the vein for transfusion or other intravenous medication, whereas trained technicians or internes who are accustomed to such work rarely have trouble. I am sure that one who only occasionally tries to inject a hernia is likely to have trouble, and bad or even dangerous results would be likely to follow some of the solution getting into the peritoneal cavity or into the cord structures. Time will tell, of course, just how extensively this treatment will be used, and Dr. Bratrud has made a definite attempt to demonstrate its value. A few papers on the subject have been published before, but they have not been well received by the medical profession.

We must not be too critical of this method, because we should remember that until a few years ago hemorrhoids and varicose veins were looked upon as surgical conditions, and their treatment by injection was considered a method to be used only by quacks, yet at the present time its value in this field is recognized by the medical profession and the procedure is being used extensively.

There is no doubt that certain indirect inguinal hernias can be cured by this method. Personally, I have had no experience, but after hearing Dr. Bratrud's paper, seeing his demonstrations at this meeting, and noting the enthusiasm of Dr. F. L. Smith, who is in charge of the injection of veins and occasionally injects hernias at The Mayo Clinic, I feel that the method is sometimes justifiable. We must not lose sight of the fact, however, that the great majority of hernias to which this type of treatment is applicable, namely, the reducible type of indirect inguinal hernias, are those in which good results can be expected from ordinary surgical methods. The size of the hernia, provided it is reducible, does not make much difference. The types of hernias that are difficult to cure by surgical methods are the types in which this method would not be indicated, and my experience in recent years with live sutures made from strips of fascia lata has made me feel that surgery is by all means the safest and best method of repairing such hernias. There is no doubt that the percentage of recurrences following surgical operations is much higher than the medical profession as a whole realizes, and the most important reason for this is probably that many operations for hernia are done by men with little surgical

experience. Furthermore, when foreign suture material is used in the closure of large hernias, especially those of the direct type in elderly people, in which considerable tension is necessary to bring the tissues together, the sutures frequently cut through, leaving a wide open inguinal canal. I am satisfied that if the injection method is ever used extensively a great many recurrences will follow.

Frequently, we see patients who have been told that they had a hernia, but who have just a slight bulging or suggestion of a direct hernia, and I do not feel that operation is indicated. It is also true that many patients with a congenital, indirect, inguinal, hernial sac never have any bulging because the muscles at the level of the internal abdominal ring keep the neck of the sac securely closed, and I do not advise exploration of the inguinal canal unless I am able definitely to demonstrate a hernia. I am satisfied that occasionally patients are operated on for inguinal hernia when none exists, and I am sure that a great many patients have been treated by the injection method by quacks when no hernia existed.

The fact that patients are ambulatory during the course of treatment will make this method popular in many localities but in the clinic in which I work, extensive use of this method would result in little saving of time or expense to the patient.

There is no doubt that this method is relatively safe in the hands of men who have had extensive experience, but if the method ever becomes popular, I am inclined to think that many accidents will happen, because injection of a small amount of the fluid into the cord will cause definite injury and in many cases cause atrophy of the testicle. In older patients this is not a serious consideration; in fact, in repairing hernias in elderly men I think it is a good plan to remove the testicle and cord. If this is done, closure of the inguinal canal is a simple and satisfactory procedure, especially if live sutures are used.

I cannot agree with Dr. Bratrud on the advisability of this type of treatment in femoral or epigastric hernias. In the great majority of femoral hernias, the protrusion felt is a large preperitoneal fat tag with a very small hernial sac inside, and it is seldom that any abdominal viscus enters this sac. If it does, strangulation is apt to occur.

If the crural canal is blocked by fibrosis following injection, a palpable mass will remain just below the crural canal, and, even if there is no danger of strangulation, the patient will have some discomfort and will still think that he has a hernia. The same thing is true in cases of epigastric hernias. In the majority of such cases, there is no peritoneal sac. The protruding mass is merely preperitoneal fat, and the discomfort is caused by traction on small sensory nerves that accompany it. The surgical cure of this condition is accomplished so easily and satisfactorily under local anesthesia with little hospitalization of the patient that I consider any other method of treatment unwarranted.

Dr. Bratrud said that the fitting of trusses is an important matter. It is most unfortunate that the fitting of trusses has been more often in the hands of quacks and drug-store clerks than of physicians. When most of us went to medical school, there was no instruction whatever in the fitting of trusses, but I am glad to know that the University of Minnesota and some of the other universities in this country are instructing students in the proper fitting of trusses. This, I feel, is a real step in advance, as I am sure that a great many patients without actual hernia are wearing trusses at the present time, and that many who have hernias are wearing ill-fitting, cumbersome trusses that furnish little protection against strangulation.

With regard to reduction of weight in stout patients, putting them in bed and reducing them is going to take time. If the patient is a good surgical risk, even if he is overweight, I seldom have him reduce. I have operated on several patients who weighed over 250 pounds, and there is no reason why they should not have their hernias operated on. Perhaps the reduction in weight advised in these cases, in order to make palpation of the internal ring and cord structures easier, is going to take about as much time as operation.

Dr. Bratrud referred to the necessity of thorough coöperation on the part of the patient. I feel that this is just as important in cases following operation as it is after injection, for I have had some unfortunate experiences. At the present time I have among my patients a man who got out of bed three days after operation because of a slight disagreement with his nurse. I can recall another patient, a man on whom I had operated for a large hernia, who got drunk and engaged in a fight the second night after leaving the hospital. I do not know whether he had a recurrence or not. Violent exercise of that kind should be avoided for at least three months.

Dr. Bratrud mentioned the danger of getting some of the solution into the peritoneal cavity. I feel that there is more danger of this at the hands of beginners or amateurs than his remarks would indicate. In his hands there is probably not much danger, but pain cannot be relied on as a warning that the peritoneum has been reached because if the novocain has also reached that deep, there would be no pain, and injury to the bowel or sufficient irritation of the peritoneum to cause firm adhesions might result.

There is no doubt that this method is going to be tried out extensively in the near future, but I think it should be in the hands of specialists and that only suitable cases should be treated. I am sure we shall all be interested in the statistics after a sufficient number of cases has been treated by this method.

Dr. Carl O. Rice, Minneapolis: The histopathologic changes which take place in the tissues, after the injection treatment of hernia, have been found to be such that it seems justifiable to proclaim the efficacy of the method on this basis as well as on the results of clinical trial.

The unpublished work performed by Dr. Bratrud,

on the dog, has demonstrated very clearly that dense white nonelastic fibrous tissue is formed after the injection of the solution into the abdominal wall. More recently Dr. Hamline Mattson and I have obtained biopsies from patients who have been operated upon for the cure of their herniæ after having submitted to one or two injections at varying intervals before the operation was performed. In brief, our investigation has shown that the reaction which takes place is that of fibrous tissue proliferation from its early stages, in which the major portion of the tissue consists of young fibroblasts, to the mature stage when all the fibroblastic tissue has been converted into dense nonelastic fibrous tissue. The reaction from one injection extends over an area approximately two centimeters in diameter. When the solution is placed in the inguinal canal, deep to the fascia of the external oblique muscle, it is found that fibrous tissue is produced so that the cremaster muscle and spermatic fascia below become densely adherent to the fascia of the external oblique muscle above. This aids in constricting the inguinal canal. Instead of being easily dissected, as can be done in an uncomplicated hernia operation, the loose areolar tissue in the inguinal canal and between the fascial planes is replaced by dense fibrous tissue.

Conceivably, then, if it is possible to produce fibrous tissue where it is desired the same end-results should be obtained as with the operation, with the exception of being able to remove the hernial sac. We know, from postmortem examinations, that there are many individuals whose hernial sac extends down into the cord but who have never realized that they suffer from rupture. These were individuals in which the opening into the sac was so constricted that no contents ever entered the sac and therefore never caused symptoms. It therefore becomes our problem to produce a similar situation by the injection treatment. That, as a matter of fact, is exactly what we do accomplish.

For example I may cite a case which, through our error, will clarify the technic and likewise demonstrate the results which may be obtained if the technic is not properly carried out: A man, aged 50, had a large bilateral indirect inguinal hernia with contents in the scrotum making it so large that the entire mass measured about 20 centimeters in diameter. He had received thirty injections on each side over a period of one year. Although the herniæ had been reduced considerably in size and could not be made to extend more than three or four centimeters beyond the external ring we were unable to completely close them and decided to operate upon this patient. At the time of operation dense fibrous tissue was found under the fascia of the external oblique muscle, adherent to the cremaster muscle and spermatic fascia of the cord. This tissue was tough and could be dissected out only with difficulty. It gave the appearance of a hernia which had been operated upon previously. At the internal ring the fascia and scar tissue extending from the cord was spread out fan-wise to become continuous with the internal oblique muscle, thereby keeping the internal ring open at its point of exit from the peritoneal cavity. It was clearly evident in this case that we had gotten no results because the injections were placed superficial to the internal oblique muscle at the internal ring instead of deep to this structure where the hernial sac dips down to become continuous with the peritoneal cavity.

The nature of the condition which Dr. Bratrud has spoken of as induration of the cord for a time could not be fully explained. After having seen a number of these sequelæ and having observed that following this reaction the sac became obliterated in most instances, it was decided to insert an aspirating needle into this mass. After passing through three or four millimeters of tough indurated tissue the needle dropped into a space from which yellow transparent fluid was obtained. This fluid appeared similar to what is found in a hydrocele. From these facts the following deductions were made. The injected solution had been placed in the cord close to or into the hernial sac. This resulted in a chemical inflammation of the sac, edema of the surrounding tissues, closing off of the sac at the internal ring, and injury to the epithelial lining of the sac with consequent production of an exudate into the sac. After the absorption of this exudate or removal by aspiration, complete fibrinous obliteration of the sac occurred.

This contention was definitely proven by examining the specimen from one patient who, in all probability, could have been cured by the injection method if he had allowed us to continue the treatments.

In using the Phenol, Alcohol and Thuja mixture it has been demonstrated that the dose should not exceed 6 minims. In several instances 8 minims has produced a small area of necrosis in the tissue. This necrotic area did not produce trouble and in all probability would have resulted in resolution and replacement by fibrous tissue but it seems undesirable to obtain that much reaction. It is possible that the occasional systemic reaction with nausea and a feeling of lassitude on the second or third day after injection has been the result of necrosis. Since we have been using smaller doses at each injection we have observed fewer of these systemic reactions and also fewer indurations of the cord.

The end-result from this method of treatment cannot accurately be adjudged at this time because our results do not extend over a period of more than two years. From evidence at hand, however, I believe that we are justified in proclaiming this method of treating hernia as one which will not completely replace the surgical method but supplant it in those individuals who prefer not to have an operation and in those cases where surgery is contraindicated.

Dr. G. A. Earl, Saint Paul, Minn.: The first time I became interested in this work was because of a patient who had been operated twice with recurrences, the first time by someone else, and the second time by myself. Dr. Bratrud, with truss and injections, has produced a satisfactory result.

It may be that with the use of fascial tissue and more careful surgical work, there might not have been a recurrence from the surgical treatment. The operations had been done years previous.

Nevertheless, it was so interesting that I began the work one year ago. The more I see of the treatment, the more I become convinced that the method is here to stay along with surgery in the treatment of hernia.

We must first carefully diagnose the type of hernia. The speakers have pointed out the contra-indications. We have to take into consideration the age of our patients. If I have a youngster coming in with a beginning indirect inguinal hernia, I can assure him that it probably is going to take relatively few injections. If I have an aged man, in whom the tissues are weak and attenuated, and in whom there is a large hernia, I warn him that he will have to be more patient and that it may take many injections.

I have listened today with great interest to Dr. Bratrud and Dr. Rice. I feel that Dr. Bratrud has been a pioneer in this part of the country in taking this matter out of the realm of questionable practice and placing it where it belongs, in the hands of those who are more experienced in all the problems involved.

Dr. A. F. Bratrud (closing): I wish to thank Drs. Rice, Earl and Masson for discussing this paper and for the very frank and liberal discussion of same.

As far as replacing the surgical treatment of hernia by this method, I do not wish to convey the impression that it will. I am operating upon more hernias today than I ever have, but this is probably because of the volume that I see. Where large hernias cannot be properly reduced and held in place by a truss, plastic repair should be performed. Plastic repair of a hernia is not difficult. Without plastic repair there is going to be a very high percentage of recurrences.

I was particularly impressed with what Dr. Rice said in regard to early proliferation of tissues. Travis and Hall of New York University, in 1929, did some work with different solutions, and stated that proliferation began about the ninth to the twelfth day. Some of our sections show exactly what Dr. Rice has stated. There is edema of the tissues within twenty-four hours, and proliferation begins between the third and fourth days. We did not believe it was possible to obtain proliferation of fibroblastic tissues as early as this.

Only one injected case has to our knowledge come to autopsy. This was performed by the pathologist at the Midway Hospital in St. Paul. Careful dissection was made of the inguinal region, and he stated that there was such a perfect closure that he was unable to shove his thumb through the inguinal ring.

I feel that we can go on record and state that by using the combined method of treatment, that is, surgery with injections, we can reduce recurrences of hernia following operation to almost nothing.

These patients should be fitted with a truss after operation so as to give them additional support until there is perfect union. If there is any question of beginning recurrence or weakness, the case should be supplemented by injection to avoid recurrence following operation. As far as I know, I do not believe that there has been a single recurrence at the University of Minnesota following operation, since this treatment was started, although we have had three or four cases that have been supplemented by the injection treatment before recurrence was present.

It is surprising to me how many hernia patients show atrophy of one or both testicles upon the first examination. All patients should be examined for this.

Patients are advised to take proper care of their bowels after operation. They are also informed that they have a weakness which has been present since birth, and should they develop a cough, they should replace their trusses and wear them during that time. They are also advised to wear a truss during any period of heavy lifting or severe exertion.

Dr. Masson made a statement in regard to fat pads in umbilical, femoral or epigastric hernias. I have seen tremendously large sacs with a small neck in epigastric hernias. Where there is a fat pad present in the sac, the cases are not injected. This is a specific contraindication to this form of treatment. As a rule, pain in these cases is aggravated by the application of a truss, and unless pain and all symptoms can be completely relieved, the case is surgical.

As far as failure is concerned, we know of at least three failures to date. All of these are in cases which should have been surgical and they were so advised at the beginning of treatment, but insisted upon having the ambulant form of treatment.

Recurrences at the present time are low, but with the type of patient and type of hernias which we are treating, I shall be very well pleased if we can keep our recurrences below 10 per cent.

CLINICAL TUBERCULOSIS AMONG EMPLOYES OF LOCAL INSTITUTIONS CARING FOR TUBERCULOSIS PATIENTS†

A. T. LAIRD, M.D.

Nopeming, Minnesota

"There is a good deal about Dr. David A. Stewart of Manitoba which is reminiscent of his fellow countryman the late Sir William Osler. Stewart, like Osler, has a choice collection of English words and classical quotations which he uses with intelligent and charming skillfulness. But more important in fixing his place in literature is the fact that David Stewart is a great physician who knows the people who have tuberculosis as he knows the tuberculosis his patients have."

THIS tribute to Dr. Stewart was penned I suspect by Dr. Hoyt E. Dearholt, the editor of the Wisconsin *Crusader*. In the June 1934 issue, "Some Postulates" by Dr. Stewart are briefly given, which have a direct bearing on our subject; one of them is the following:

"The outstanding fact about tuberculosis is that it is an infectious disease. If there is even slight occasional contact, infection is likely; if contact is close infection is inevitable; if prolonged, disease will likely follow infection sooner or later; and when disease is once established, then disability, crippling, scattering of infection and death are all in the offing."

Heimbeck,[3] Geer,[1] Myers[5] and others have shown that nurses and medical students beginning their training often do not react to tuberculin; their studies and bedside work bring them in contact with open cases of tuberculosis and in the upper classes of the schools they attend, a much larger proportion give positive reactions to tuberculin.

In such schools Rigler[6] and others have been able to follow, in certain cases, the development of pulmonary tuberculosis from its inception, through various stages, to complete resolution or to the development of clinical disease.

Local Experiences*

NOPEMING SANATORIUM

In the twenty-three years that have passed since the opening of Nopeming Sanatorium there have been nearly 2,000 (1,987) employes. Included among them there have been fifty-seven physicians, 589 nurses, twenty-two nurses helpers, ten dietitians, 107 orderlies, 170 serving kitchen helpers, all brought in rather close contact with tuberculous patients. Besides them, there have been 197 maids, fifty-one laundry workers, 279 janitors, porters, choremen, etc., not to mention other persons variously employed.

Pupil Nurses.—Of the 589 nurses at least thirty-six had shown evidence of clinical tuberculosis at some time previous to their employment. Of the remaining 554 nearly a third were pupil nurses and about two-thirds graduate or practical nurses. For sixteen years, from 1915 to 1931, inclusive, the Sanatorium conducted a training school for nurses. The course given was one year in length. The school was accredited by the State Board of Nursing Examiners. Some of the girls after completing the course continued their studies in general hospitals and became graduate nurses. Most of the pupil nurses were between seventeen and twenty-two years of age.

Of the total enrolment in the school, amounting to 193, there were five who remained less than a week. Of the 188 who stayed longer, 113 remained the full year and completed the course. Of the entire 188, there were eighteen who were known to have had clinical tuberculosis before enrolment. Of the 170 remaining six have died of tuberculosis. Four of these six gave a family history of tuberculosis. All six worked in other tuberculosis institutions before or after their year of training at Nopeming.

Beside these six, at least eleven others have developed somewhat definite clinical tuberculosis. Five of these had close relatives who were tuberculous. The others worked for considerable periods either before or after their course of study at Nopeming in other institutions where tuberculous patients were cared for.

Altogether there have been seventeen known cases of more or less definite clinical tuberculosis in this group of young pupil nurses, mostly under twenty years of age.

†Read before the Trudeau Society at the Annual Meeting of the Minnesota State Medical Association, Duluth, July 16, 1934.

*These summaries have been corrected to May 1, 1935.

There may have been others as it has been impossible to secure reliable data regarding all former pupils. Bad news, however, travels fast and it is probable we would have heard of cases of serious illness through correspondence between classmates or otherwise.

The school was discontinued in 1931. The last class numbered twelve pupils. All were given Mantoux tuberculin tests (0.1 milligram old tuberculin) on September 30, 1930. All but two showed negative reactions. On October 3, 1930, the ten showing negative reactions still did not react to injections of a full milligram of old tuberculin intracutaneously but on February 6, 1931, every member of the class reacted positively even to one tenth milligram.

Two members of this class have shown evidences of clinical tuberculosis, one of them developing parenchymal lesions in the lung and some suspicious symptoms which have since disappeared. She was given strict rest treatment and is now in apparently good health. The other one developed an adenitis in the left axilla. A biopsy of this gland has shown the presence of tubercle bacilli.

Graduate and Practical Nurses.—The 359 graduate and practical nurses who have been employed at Nopeming were as a rule older than the pupil nurses just considered. Most of them were between twenty-five and forty years of age. Eighteen had been tuberculosis patients. Of the 341 remaining, five are known to have developed some evidence of clinical tuberculosis. One, a graduate nurse has died. Her death occurred some years subsequent to her residence at Nopeming, after her marriage to a patient who died from the disease.

Women Employees.—Beside the 58 nurses 643 other women have been employed at Nopeming. Five of them developed clinical tuberculosis. One of them died. She was a sister of a patient who had both pulmonary and glandular tuberculosis. Another woman employee had positive sputum; she was given sanatorium treatment. Two who had parenchymal x-ray lesions with symptoms but not positive sputum were put to bed. The fifth one had a parenchymal lesion and a few symptoms. She was simply kept under close observation.

To us it seems quite evident that among women who are sanatorium employes we are likely to find more cases of clinical tuberculosis in the nursing group than in the groups not brought in such close contact with patients. Among the nurses there are likely to be more cases in the age group under twenty-five than between that age and forty.

Physicians.—Of fifty-seven physicians who have been employed at Nopeming, six were tuberculous patients before entering service. Three who came with negative Mantoux reactions later gave positive reactions. One physician since leaving Nopeming has had hemoptysis but is now in good health.

Male Employes.—Of 700 male employes, not physicians, about 150 were ex-patients. Of the 550 others, three have died of tuberculosis. One was a man seventy-one years of age who had been a night watchman and janitor at Nopeming for fourteen years before becoming ill. Previously he had been a farmer, coachman and a worker in a factory where pipe and boiler covering was made. X-rays had shown some evidence of old presumably healed tuberculosis. Another man died at Nopeming of tuberculosis after four years of service as porter and janitor. He was forty-seven years of age. The third patient was twenty-four years of age. There was no family history of tuberculosis. He had worked at Nopeming five years as a fireman and had very little contact with patients.

One other case of well advanced clinical tuberculosis is known to have developed among male employes who were not ex-patients.

Duluth Hospitals

Since 1931 in the two larger Duluth Hospitals, of 331 pupil nurses given Mantoux tests (0.1 milligram old tuberculin) at a date near the beginning of their training, 112 (50 per cent) gave negative reactions. Both hospitals have had tuberculosis divisions for ten years. It has not been possible to arrange for tests at the close of training but second tuberculin tests have been given to a number of those showing negative reactions at the first test. Thirty-one girls having negative tuberculin reactions on admission are known to have shown positive reactions seven months to two years later. It is probable that the entire group would have shown positive reactions at the close of training as this is the usual experience in other hospitals where tuberculosis patients are treated.

Since 1931 x-rays have been taken of all of the pupil nurses in both hospitals upon admission to training. In at least twelve cases some evidence of tuberculosis was found on the first x-ray examination. Subsequent x-rays have not been taken except in certain suspicious cases or in some instances after a negative Mantoux reaction was replaced by a positive one. The rule followed in certain hospitals of taking x-rays of the nurses every six months or even every three months seems to me to afford more protection.

In one of the hospitals there were 585 pupil nurses in training during the ten year period from January 1, 1925, to January 1, 1935. Among them, twenty (about 3.4 per cent) showed some evidence of clinical tuberculosis; ten (1.6 per cent) showed definite pulmonary lesions with symptoms and received treatment; one of these died; of three we have no report as to present health; four returned to work and have kept well; one never worked in the tuberculosis division. In addition to these ten, five of the other girls had pleuritis and five were classed as suspects.

In this same hospital, fifty-eight employes not nurses have been examined. This group included men and women of various ages. Thirty-two (55 per cent) of these adults gave negative reactions to the Mantoux test. These tests have been repeated in a few cases, but in not enough to warrant definite conclusions. In a number of cases where there is no close contact with tuberculosis the reactions have remained negative. X-rays were also taken of all the members of this group. In only five was there any evidence of parenchymal pulmonary lesions. One employee was found to have active pulmonary tuberculosis and subsequently died.

It seems to me it must be evident that in hospitals and sanatoriums so far as nurses are concerned, contact is clear and infection is inevitable. Disease will likely follow if the contact is prolonged, unless special precautions are taken to limit the amount of infection and prevent undue operation of predisposing causes.

Although a slight amount of infection may be of advantage to the individual who has acquired it, under present conditions the amount of infection to which employes are exposed in hospitals is so difficult to control that it should be reduced to a minimum.

At the present time there is probably less exposure than there has ever been and it has not been shown that there is any increase in the number of clinical cases developing over what has actually occurred in previous years.

Nurses and medical students can not expect that all risks connected with their studies be removed but they can ask that unnecessary exposure to infectious disease be eliminated.

Geer[1] has demonstrated that at least the incidence of actual illness can be reduced. The amount of clinical tuberculosis among pupil nurses in the Ancker Hospital in Saint Paul, following the introduction of a strict aseptic technic, has been reduced from 5.5 per cent among 112 pupil nurses, from 1928 to 1930, to 1.6 per cent among 181, from 1930 to 1932. Yet even with this technic practically all the nurses still leave their training with positive tuberculin reactions. Geer's recommendation that every patient admitted to a general hospital should be studied thoroughly, preferably by x-ray to exclude unsuspected sources of infection deserves careful consideration. At Glen Lake Sanatorium,[2] Oak Terrace, Minn., all nurses have x-rays taken of their chest every three months.

The technic Geer describes is especially applicable to bed patients and practicable methods for protecting contacts more thoroughly from infection by ambulant positive sputum cases are still to be devised. Dr. Jennings[4] of Glen Lake has been studying the problem.

In spite of our best efforts it is probably impossible to prevent entirely the infection of contacts of positive sputum cases whether in the hospital or in the home. The infectious patients, however, can be isolated from their families in hospitals, and there the amount of infection to which nurses are exposed can be reduced so that it need not be massive or prolonged. To prevent clinical disease we must also limit the operation of predisposing causes. That they are still an important factor in the production of illness is shown dramatically by Whitney.[8] According to her tables, medical students and physicians may often acquire infection, but their mortality from tuberculosis is less than that of men in various other occupations. In 1930, among gainfully employed males, the death rate per 100,000 in the United States for physicians was 27; agricultural work-

ers, 45; clerks, 68; skilled workers, 69; unskilled laborers, 194; and for factory and building construction laborers, 239, nearly ten times the physicians' rate.

We have no similar figures for nurses. Their mortality from the disease is doubtless somewhat higher than in other occupations. At least we know that their morbidity from the disease in hospital service can be reduced.

Let me close with another of Dr. Stewart's[7] postulates:

"One prime essential is to cover the field, to follow up every clue with examinations and re-examinations, to bookkeep carefully year by year records of all known sources of infection and all people possibly infected. To find tuberculosis early there is one way only, and that is to hunt for it among people who are not yet ill but who have been in contact with open disease."

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TREATMENT OF CARDIAC EMERGENCIES*

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THE history of heart disease is usually that of slow, gradual progress, but at times the course is interrupted by acute crises, the proper treatment of which may be life-saving. The present report consists of a discussion of the mechanisms underlying the most important cardiac emergencies and the therapy. Mention will also be made of treatment which may be directed at the prevention of these critical states.

Pericardial Effusion

There is no doubt that patients are occasionally permitted to die because of failure to aspirate an effusion in the pericardial sac. A study of hospital records by Williamson and Ets[8] of Chicago disclosed the following: Of fifty-four cases of pericardial effusion which came to autopsy there were nine in which no puncture was done and in which it seemed reasonable that this procedure might have been life-saving. In four other cases pericardial puncture would have been of great benefit, if not life-saving. The physiological changes brought about by a pericardial effusion are demonstrated best by experiments in animals. If fluid is injected into the pericardial cavity of a dog and the intrapericardial, venous and arterial pressures are measured, it will be found that as the intrapericardial pressure rises, the venous pressure goes up and the arterial pressure and cardiac output are reduced correspondingly. For a given increment in pericardial pressure these changes are more pronounced at higher pressure levels. The circulation comes to an end when the intrapericardial pressure equals that in the venæ cavæ so that the great veins are completely collapsed. It is, therefore, characteristic in acute pericardial effusion for death to be sudden in patients supposedly in good condition. This may be explained by the sudden increase of intrapericardial pressure to the critical level at which the venæ cavæ collapse. There is no method by which the changes in the intrapericardial pressure or pressure in the vena cava may be measured. However, some information as to prog-

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ress may be obtained by careful and repeated observation of the arterial pressure. A steady fall of the blood pressure and especially a sudden increase in the rate of the fall is a danger signal. If this is associated with increased respiratory distress, cyanosis and distension of the jugular veins, aspiration should be performed at once. The fluid first accumulates about the apex of the heart and then gravitates toward both pleural cavities with the largest volume along the left border and posterior to the heart. The best site for aspiration is in the fifth interspace just within the left border of the cardiac dullness. Here the distended sac is in close contact with the chest wall and the pleura is pushed aside. A long needle of about one millimeter calibre attached to a fifty or 100 c.c. syringe should be used. The syringe can be removed and emptied and then connected again until the proper amount has been removed. It is advisable to anesthetize the skin and subcutaneous tissue. The needle is inserted in the interspace and slowly directed upward, backward and medially toward the hilus of the left lung. After forcing the needle in this direction a variable distance, usually about 4 cm., it is possible in most cases to feel the penetration of the firm pericardial membrane. If fluid is not obtained the needle should be inserted more deeply and the direction changed. There is very little danger in exploring in an attempt to localize fluid. The cardiac pulsation is usually felt against the needle when the heart is reached. If fluid is not obtained at this site, aspiration should be attempted posteriorly below the angle of the left scapula, especially if there are signs of compression of the left lung posteriorly. The left arm is raised so that the scapula is rotated upward and the needle is inserted in the eighth or ninth interspace for a distance of about seven or eight centimeters. In some cases, especially with tuberculous effusions, there is a tendency for the fluid to reaccumulate rather rapidly. This may be prevented in a measure by injecting air following the removal of fluid. A volume of air equal to about one-half the amount of fluid removed should be injected. This has been carried out by the writer in two cases with satisfactory results.

Embolic Manifestations

Mural thrombi frequently form in the auricles in rheumatic heart disease and in the ventricles in coronary disease. Occasionally portions of a thrombus dislodge and pass into the circulation. The manifestations depend upon the site at which the embolus lodges and the size of the embolus. Two points may be emphasized: first, the frequency of this accident, and second, the stage in cardiac disease at which embolic phenomena appear. There is a general impression that embolic accidents are characteristic of acute inflammation of the heart valves, subacute bacterial endocarditis, but are rare occurrences in chronic heart disease. Laws and Levine,[1] however, found that in seventeen of 148 cases (11.5 per cent) of chronic rheumatic heart disease, death was embolic in origin. A wrong impression also is that embolic phenomena occur in the late stages of heart disease, leaving little to be gained by treatment because of the serious nature of the underlying cardiac condition. This is decidedly an erroneous conception. Emboli particularly in rheumatic heart disease may interrupt the course of the disease at a very favorably period. In practically all cases reported by Laws and Levine cardiac compensation was practically normal at the time this circulatory accident occurred. One gains the impression that had not the embolus occurred, the patient would have lived for a considerable length of time. I have observed emboli in a patient with chronic valvular disease ten years before the patient died of congestive heart failure.

As to recognition, there are several points which may be helpful. First, emboli in chronic heart disease occur almost uniformly with auricular fibrillation. In the seventeen cases of embolism reported by Laws and Levine, fibrillation was present in sixteen. Therefore, in chronic auricular fibrillation, if there is a sudden onset of manifestations which may be attributed to ischemia of an organ, the most probable explanation is an embolus from an intracardiac thrombus. Occlusion of a large pulmonary branch may lead to sudden death. Manifestations of blockage of a smaller branch are sudden pain in the chest, cough and dyspnea. Hemoptysis may occur but is not an essential feature. Morphine is indicated and oxygen, if pulmonary congestion and cyanosis are present. Occlusion of mesenteric branch in its typical form manifests itself in a sudden attack of colicky abdominal pain, later followed by bloody stools and by symptoms of intestinal obstruction. The immediate treatment is the relief of the pain by morphine and the treatment of shock if it is present. Although the

prognosis is very gloomy, recovery may follow surgical intervention and occasionally recovery is spontaneous. Recently Sargent[7] reported a case of mesenteric thrombosis which was explored, but resection was not done because of the age of the patient and the amount of tissue involved. The patient after a stormy period made a complete recovery. Meyer[2] reviewed ninety-two proved cases of mesenteric thrombosis which have been reported in the past ten years. There were thirty-nine recoveries and fifty-three deaths, or a gross mortality of 57.6 per cent. There were forty-three cases in which resection of the affected bowel were done with a mortality of 32.6 per cent. Recoveries included three cases of practically complete removal of the small intestine. It is therefore evident that resection of the involved bowel offers the best hope for recovery and should be done without delay.

Peripheral Emboli

Occlusion of a vessel of an extremity is usually evidenced by pain, pallor and reduced temperature in the involved limb with absence of arterial pulsation. The pain is usually referred to a point distal to the site of the obstruction and, therefore, is of no aid in localization. In Zierold's[9] series of twenty cases the lower extremities were involved in eighteen and the upper in two. He found that the point of most frequent occlusion was in the lower portion of the femoral artery above the popliteal space. The next most frequent site was at the branching of the profunda femora. Embolectomy should be performed as soon as the diagnosis is made and the site of the occlusion localized. Operation, however, is not entirely hopeless even after a considerable period has elapsed. In two patients of Zierold's series circulation was restored by embolectomy after a period of thirty-six hours in one instance, and seventy-two hours in another. Surgery is not indicated in all cases. In the upper extremity the collateral circulation is such that emboli in the brachial or axillary arteries have more than an even chance of being followed by recovery. Also emboli lodging at the bifurcation of the popliteal artery do not require surgery.

In a large measure the embolic accidents of chronic heart disease are preventable. Since emboli are rare when the heart is beating regularly, the preventive treatment consists in an attempt to restore normal rhythm in auricular fibrillation. This may be accomplished in at least 50 per cent of the cases by the proper administration of quinidine.

Abnormal Cardiac Rhythms

The sudden onset of a very rapid heart rate may give rise to acute symptoms, either pain, dizziness or respiratory distress. The mechanism is usually the development of an abnormal rhythmic focus in the myocardium, in the auricles, junctional tissues or ventricles, but may be a paroxysm of auricular flutter or fibrillation. The cardiac efficiency becomes markedly reduced, the minute volume being reduced to approximately 40 per cent of the normal. Although attacks do not usually endanger life, they cause considerable distress and anxiety. Occasionally prolonged attacks may exhaust the heart muscle and lead to fatal heart failure. The methods for terminating the attack consist of stimulation of the vagus nerve by various means, and of administering drugs which act on the myocardium. Reflex stimulation of the vagus nerve is obtained by pressure over the carotid artery, by ocular compression, by deep breathing or holding the breath and by inducing gagging or vomiting. The most effective method of vagus stimulation is by pressure over the carotid sinus, a localized portion of the internal carotid artery. Pressure is made on the carotid pulsation at the level of the thyroid cartilage and is continued for from fifteen to thirty seconds. The right carotid artery should be compressed first and if there is no effect, pressure should be applied on both sides. The results may be very dramatic, as the paroxysm may cease instantly. The vagus may also be stimulated chemically by the use of a cholin derivative, acetyl beta methylcholine.† A dose of twenty to thirty millegrams subcutaneously will often terminate an attack. In studies which are in progress[3] it has been demonstrated that acetyl beta methylcholine exerts its maximum effect on the heart about five minutes after a subcutaneous injection. If there is no effect within five minutes, carotid pressure should then be carried out and this additional procedure is

†Acetyl beta methylcholine chloride is marketed under the trade name of mecholin in sealed ampoules. A convenient method is to dissolve the contents of a 0.1 gm. ampoule in 5 c.c. of distilled water. The substance is freely soluble in water, and the solution does not deteriorate on standing. The material is then ready to be injected in from 1 c.c. to 1.5 c.c. doses.

almost uniformly followed by termination of the paroxysm. The other effective measure is the administration of drugs which depress the excitability of the myocardium. The most effective compound is quinidine. During the attack quinidine sulphate may be given in doses of five grains every hour for five or six doses. This is particularly effective in tachycardias of ventricular origin. This drug is also valuable as a prophylactic measure in cases in which the attacks are frequent. The dose should be from ten to twenty grains a day. It is also important to eliminate all possible exciting factors such as tobacco, coffee, constipation, fatigue and physical and mental strain.

Cardiac Syncope and Sudden Death

Cardiac syncope is a sudden and temporary loss of consciousness due to a cerebral anemia of cardiac origin. Sudden cardiac death may be considered as a fatal cardiac syncope. These conditions may be discussed under abnormal rhythms since they are usually due to a disturbance in the rhythmic contraction of the heart. The treatment must be largely preventive in nature, since the onset is so sudden and recovery or death occurs so promptly that it is usually impossible to treat the attack.

Temporary loss of consciousness in heart disease is usually associated with complete heart block, the Adams-Stokes syndrome. The syncope is due to a ventricular standstill in most cases. In studies already reported,[4] it was demonstrated that cardiac standstill may be induced in many human subjects by pressure over the right carotid artery. This affords an accurate method for evaluating the effectiveness of drugs in cardiac standstill. From results of an extensive study on a number of drugs it was found that the only effective substances were adrenalin and chemically related compounds. Adrenalin is the most active and should be used in doses of 1 c.c., 1-1000 solution, subcutaneously every three hours when syncopal attacks are frequent. Proper administration of adrenalin is by far the most effective means of preventing syncopal attacks due to cardiac standstill. In cases in which oral administration is desirable, ephedrine sulphate may prevent attacks but large doses are usually necessary. It is useless to employ less than 50 milligrams three or four times a day. If this is ineffective, the dose should be increased to 100 milligrams. If the attacks still continue, it will be necessary to resort to hypodermic medication with adrenalin. Occasionally standstill is observed on the operating table, following certain poisonings and associated with asphyxia of the newborn. In these cases it is necessary to administer adrenalin by intracardiac injection. This often produces miraculous results. The dose should be 1 to 2 c.c. and should be injected with a long needle penetrating the chest in the fourth or fifth interspace over the heart. Blood should first be aspirated to prove the entrance of the needle into the cardiac cavity. A part of the solution is then injected and the injection continued as the needle is withdrawn in order to make certain that some of the adrenalin is deposited within the heart muscle.

Some recent studies[5] which are still in progress indicate that there are possibilities in the prevention of the fatal cardiac syncope which is the characteristic termination of the anginal type of coronary disease. An analysis of 142 autopsies of sudden death associated with coronary disease showed that myocardial damage sufficient to explain the death was present in only 7 per cent of the cases. Sudden cardiac death therefore is usually the result of the onset of a physiological mechanism in the heart which is incompatible with life. It is practically conclusive that this mechanism is ventricular fibrillation, a condition in which the normal contraction of the ventricular myocardium is replaced by rapid irregular movements of a minute amplitude. The muscle goes into a state of fine quivering and twitching resulting in a completely ineffective contraction. In the development of experimental and clinical ventricular fibrillation the heart passes through a pre-fibrillation state in which premature beats develop at a rapid rate from multiple foci in the ventricles. These pre-fibrillation rhythms can be induced in man by the intravenous injection of adrenalin. It was found they can be uniformly prevented by the administration of quinidine. It is therefore recommended that quinidine sulphate be used as a prophylactic measure in coronary disease in the following situations: first, during a period of two or three weeks following coronary thrombosis, and second, in cases of angina pectoris in which ventricular extrasystoles develop. The doses should be five grains three or four times a day.

Cardiac Asthma

Cardiac asthma or paroxysmal cardiac dyspnea occurs usually in heart disease which affects primarily the left ventricle. It is therefore associated with hypertension heart, sclerosis of the left coronary artery, aortic valvular disease and narrowing of the orifice of the left coronary artery due to luetic aortitis. The attacks consist of paroxysms of acute orthopnea lasting from a few minutes to several hours, coming on usually during sleep but sometimes after exertion or over-eating. They vary in degree from mild and short attacks to intense agonizing seizures which may terminate in death. There are several different types of cardiac asthma.[6] The therapy depends largely on the underlying mechanism, which may be determined by examination of the lungs. If the lungs are clear the mechanism is a disturbance in the respiratory center causing cyclic breathing with the patient awakening in periods of hyperpnea. This may be effectively prevented by the intravenous injection at bedtime of 0.24 gm. of aminophyllin. If examination of the lungs reveals bronchial spasm or edema of the lungs, relief may occasionally be obtained by a tablet of nitroglycerine under the tongue. The results, however, are much less striking than in the case of cardiac pain. The most reliable and usually the only therapy required is morphine, which should be used in doses of one-fourth to one-half grain subcutaneously. The larger dose is frequently necessary. In cases showing edema of the lungs removal of 500 c.c. of blood from the veins through a large needle may be helpful. This is indicated only when there is peripheral venous engorgement as evidenced by distension of the jugular veins. However, I have been impressed with the frequency of a shock-like condition associated with pulmonary edema in which the peripheral venous pressure is low and the jugular veins collapsed due to a peripheral circulatory failure. In these cases withdrawal of blood is contraindicated; in fact, it is often impossible to obtain blood by a venipuncture. Another measure which may bring rapid improvement in pulmonary edema is peripheral venous stasis procured by the application of four tourniquets over the extremities. This is carried out most conveniently by the application of four blood pressure cuffs connected in a series to a sphygmomanometer. The pressure should be just above the level of the diastolic pressure. If this apparatus is not at hand, rubber tubing may be substituted. Pressure is continued for about ten minutes, released for a minute, and then repeated. The beneficial effects are due to a shunting of the blood from the congested lungs to the extremities. In edema of the lungs showing definite cyanosis, the administration of oxygen is indicated.

To a degree, attacks of cardiac asthma may be prevented by the use of coronary dilating drugs and the administration of sedatives at night. The evening meal should be the smallest of the day. The patient should go to sleep well propped up in bed with some way to prevent sliding down.

Cardiac Pain

Cardiac pain may be divided into two main types: (1) attacks of short duration, the anginal attack, which is due to a myocardial ischemia of coronary vasospastic origin; and (2) the prolonged attack of pain in which the myocardial ischemia is due to thrombosis of a coronary branch. Because of the short duration of the anginal attack, the physician is seldom called upon to administer treatment. The patient is instructed to carry hypodermic tablets of nitroglycerine, gr. 1/150, at all times and to place a tablet under the tongue at the onset of the attack. If the attack is not relieved within fifteen minutes after a maximum of three tablets, the pain is most probably caused by a coronary thrombosis and further administration of nitroglycerine might be definitely harmful, as the shock which accompanies the vascular occlusion may be intensified. Most attacks of coronary thrombosis begin while the patient is at rest. The pain is usually referred to the sternum or epigastrium. As to treatment, the pain can only be relieved by morphine and it is useless to start with less than one-half grain subcutaneously. This should be repeated if necessary. If circulatory collapse is present as shown by faint heart sounds, small rapid pulse and low blood pressure, stimulation with caffein, sodium benzoate, coramine or metrazol intravenously is indicated. If frequent extrasystoles or paroxysmal tachycardias develop, quinidine should be administered. Oxygen is indicated when pulmonary congestion and cyanosis are present. As already mentioned, if the patient survives an acute attack, quinidine should be administered

for several weeks in order to lessen the possibility of sudden death.

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CASE REPORTS

PAPILLARY COLLOID ADENOCARINOMA OF THE EXTRAHEPATIC BILE DUCTS*

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The extrahepatic bile ducts are seldom the site of malignancy, and a papillary colloid adenocarcinoma situated in these ducts is distinctly rare. Such a case was recently encountered by one of us (Walters) and led to a review of the surgical records in such cases at The Mayo Clinic.

Tumors of the bile ducts observed at the clinic have been previously reported by Renshaw and by Marshall. More recently, Judd and Gray have reviewed all cases of carcinoma of the bile ducts from 1907 through 1931. Including cases subsequent to their report, fifty carcinomas of the extrahepatic bile ducts have been observed at operation and the diagnosis has been confirmed by microscopic examination of removed tissue.

This figure is exclusive of malignancies of the ampulla of Vater, as we agree with Ewing that "except in very early cases it is difficult to determine the exact origin of these tumors. Some arise at the termination of the common duct, others in the mucosa of the pancreatic duct, still others in the ampulla proper or at the papilla."

These fifty tumors were situated as follows: in the common duct, thirty-three; in the hepatic ducts, ten, and in the cystic duct, seven.

Pathologically, carcinomas of the extrahepatic bile ducts are classified by Ewing into: (1) villous growths, and (2) nodular masses. He also pointed out that "more diffuse growths may extend along the duct." Of the fifty carcinomas observed at the clinic, only five, including those we are reporting, were of the villous or papillary type, three being situated in the common duct and two in the hepatic ducts.

Report of a Case of Papillary Colloid Adenocarcinoma

A man, sixty-seven years of age, complained on admission of epigastric pain and jaundice. The first attacks of pain had occurred two years previously. They had been associated with nausea and at times with vomiting, and had been sufficiently severe to require morphine for relief. Six months prior to admission, he had had another attack of epigastric pain, but this attack was less prolonged and did not require an opiate. Several times subsequently he had had slight distress in the abdomen. A week before he came to the clinic he had suffered from another attack of epigastric pain which had been more severe than any previous attack; this had been associated with vomiting and was followed by jaundice which had persisted. The patient had lost 30 pounds (13.6 kg) in the four months preceding admission.

Physical examination revealed some emaciation and moderate icterus; otherwise the results were negative. Laboratory investigations likewise revealed nothing unusual except elevation of the level of serum bilirubin to 8.8 mg. per 100 c.c., with a direct reaction. Preoperative readings of serum bilirubin in mg. per 100 c.c. were as follows: 8.8, 6.4, 7.1, 7.1, 7.1 and 7.0. At operation one of us (Walters) found the gallbladder to be of normal size. On opening it, however, a moderate amount of colorless fluid was drained out. The common duct was dilated and measured about 3 cm. in diameter. It was opened and found to be distended with masses of mucoid material, which were removed. Bits of villous carcinomatous tissue were obtained from the hepatic ducts in the region of their bifurcation (Fig. 1). The ducts were of sufficient size that they could be explored with the little finger, and at the bifurcation of the hepatic ducts a papillary lesion was found with a pedicle about 1.5 cm. in diameter. This

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Fig. 1. Villous carcinomatous tissue obtained from hepatic ducts in the region of their bifurcation.

Fig. 2. Posterior tumor in lower thoracic region.

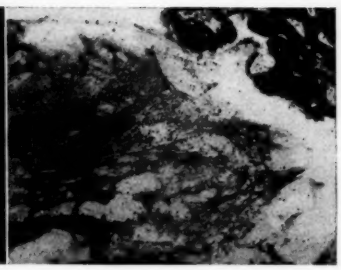

Fig. 3. Exudate from posterior tumor, showing mucus and bits of tissue having characteristics of mucoid and papillary adenocarcinoma.

tumor was quite soft and it was broken up, leaving only a small bit of the pedicle attached to the wall of the duct. This latter was inaccessible to direct attack, so two 5 mg. needles of radium were placed in the duct at this point and removed fourteen hours later. The common duct was closed over a T-tube.

The postoperative course was uneventful. The patient regained his strength slowly and the jaundice was considerably reduced two weeks after the operation, at which time the value for serum bilirubin was 3.7 mg. per 100 c.c. One month after the operation the patient was well enough to be dismissed from the clinic and to return home. Before he left, however, a tumor 5 by 7 cm. was observed posteriorly in the right lower thoracic region between the levels of the ninth, tenth and eleventh ribs. This tumor was definitely circumscribed and did not appear at that time to be related to the intra-abdominal lesion.

After the patient returned home, this tumor increased in size. It was incised by his home surgeon, three weeks later, and about "a pint of gelatinous material" was removed. Two and a half months after this operation, the patient returned to the clinic.

The mass had increased in size by this time to about 8 by 10 cm. (Fig. 2) and it was painful. It continued to discharge bloody mucoid material and pressure on the abdomen increased this discharge. A second nodule, 3 cm. in diameter, could be palpated in the abdominal wall to the left of the scar of the right rectus incision. Roentgenograms of the thorax did not reveal anything abnormal and the diaphragm was not fixed. The patient has remained free from jaundice. Microscopic examination of material exuding from this posterior tumor revealed mucus and bits of tissue having the characteristics of mucoid adenocarcinoma and papillary adenocarcinoma (Fig. 3).

Comment

Among carcinomas situated in the extrahepatic bile ducts the tumor here reported is unusual on three counts: (1) because of its villous or papillary type, (2) because of its mucoid characteristics, and (3) because of its situation in the common hepatic duct at the bifurcation of the right and left hepatic ducts.

Milles and Koucky reviewed the literature in 1932 and of carcinomas of the extrahepatic bile ducts found only thirty-seven, including one of their own, which were situated proximal to the junction of the cystic duct with the common bile duct. David added two cases in which the hepatic duct was the site of an adenocarcinoma. McLaughlin noted one carcinoma that was situated in the left hepatic duct and another that was situated in the common hepatic duct. Rolleston and McNee, in reviewing ninety-two cases of tumor of the extrahepatic biliary ducts, found that nineteen of the tumors were situated in the common hepatic duct and four in the right or the left hepatic ducts. As has been said of the fifty tumors of the extrahepatic biliary ducts encountered at the clinic, ten were situated in the hepatic ducts.

Papillary carcinomas may be of two types: papillary squamous cell carcinomas, such as are seen in the urinary bladder, and papillary adenocarcinomas, of which the case reported is an example. References to such tumors situated in the bile ducts are distinctly rare in the literature. Shapiro and Lifvendahl report one papillary adenocarcinoma among fifteen tumors of the extrahepatic bile ducts observed at the Cook County Hospital in Chicago. Rolleston and McNee, in their review of ninety-two tumors of the bile ducts, refer to only one similar to that we are reporting: "A papillomatous growth from the inside of the common duct was removed by Sir W. Bennett from a woman at St. George's Hospital. It was a branched papilloma, composed on a basis of fibrous tissue covered over by columnar epithelium. In places the columnar tissue had undergone mucoid degeneration. The after history of the patient, however, rather suggested malignant disease." Of forty-five tumors of the bile ducts examined microscopically by Rolleston and McNee, only one was found to be a mucoid or so-called "colloid" carcinoma.

The secondary tumor which appeared subsequently in the thoracolumbar region might have resulted either from metastasis or from direct extension of the primary growth. In favor of the latter theory is its presence on the right side, in a position not far from being directly posterior to the site of the original lesion. In addition, pressure on the abdomen increased the discharge from the posterior sinus. Against this theory of direct extension, however, is the observation that at operation the primary tumor was found to be apparently confined within the lumen of the bile ducts, and that when the posterior tumor first appeared it was discrete and was apparently unattached.

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INTRAMEDULLARY TUMOR OF THE SPINAL CORD*

ALBERT E. OLSON, M.D.

Duluth, Minnesota

Spinal cord tumors occur infrequently. They are of general interest because they are often confused with other diseases, especially surgical diseases of the abdomen, and because they are quite amenable to surgical correction if operated upon early enough. I shall not stress the neurological aspects except in so far as they have a practical bearing on surgical treatment.

This patient, K. D., a man thirty-eight years of age and a laborer, was first examined at our offices on March 29, 1933. He stated that until four months previous he had enjoyed good health. Then he noticed weakness of both legs and moderate aching in both knees. He stated that he did not feel secure in walking and that his condition had remained the same until four weeks before. At that time he complained of more marked weakness in both legs, especially the right. He also stumbled over small objects. He fell on three occasions and bruised the right knee quite badly. He experienced some difficulty in arising from a sitting position and in climbing stairs. No rectal or bladder symptoms and no numbness or tingling of the feet were noted.

Examination at this time revealed a definite level of sensory disturbance—corresponding to the fifth dorsal segment. All neurological findings were more marked on the right side. The tendon reflexes were increased, abdominal and cremasteric reflexes were absent, and the lower extremities were spastic. Dorsiflexion of the great toe with fanning of the other toes was elicited by the usual stimuli. There was definite quadriceps weakness.

Lumbar puncture revealed reduced pressure, slow jugular response, clear fluid, cell count four, the presence of globulin and a negative Wassermann. No protein determination was possible.

Lipiodol injected into the lumbar spinal canal with the patient in an exaggerated Trendelenburg position stopped at the level of the seventh dorsal vertebra. The arrest of this material was not a true block, but one of false arrest as proved subsequently. This sometimes occurs and is due probably to adhesions to the arachnoid and the fine structures between it and the pia.[3] It is often difficult to distinguish between a true and false arrest of lipiodol.

Blood examination revealed no evidence of pernicious anemia and the Wassermann was negative.

Laminectomy, including the third, fourth, fifth and sixth dorsal laminæ, was performed on April 1, 1933. Inasmuch as the sensory level was quite definite at the fifth dorsal segment and the lipiodol stopped at the seventh dorsal, we felt that the operation should proceed from this region up. No tumor was visualized, however, and as the patient's condition on the table did not warrant further work being done, the operation was discontinued. The patient was discharged on April 23, 1933, and was unimproved.

On May 8, 1933, he was readmitted after having been at home for several weeks. During this time, progressive neurological findings were noted. Spasticity of the lower limbs was increased, being more marked on the right than on the left side. Root pains in both shoulders were severe enough to require morphine. The patient was unable to walk at all. Partial urinary incontinence was noted. The area of anesthesia below the fifth dorsal level persisted, with hyperthesia just above it. Spinal lumbar puncture showed xanthochromic fluid, with a cell count of four and greatly reduced pressure. Cisterno puncture revealed a clear fluid with moderate increase in pressure and a cell count of four. No protein determination was possible. Lipiodol injection through cisterno puncture showed complete block at the first dorsal level.

Decompression laminectomy and exposure of a fusiform intramedullary tumor at the level of the first dorsal vertebra was performed on May 13, 1933. A portion of the tumor was removed for microscopic examination and the report was glioma of the spongeoblastoma type.

There was gradual improvement in all neurological findings and except for moderate exaggeration of tendon reflexes of the lower extremity, as well as slight clonus, gait appears quite normal. Patient is a laborer and has worked whenever possible.

This case presented, first, partial block of the spinal fluid, and, later, complete block. The syndrome presented early and late was quite typical. In fact, we have seen so few "typical" cases that this one stands out as a paradox in being an exceptional example.

Symptoms depend upon the area of involvement in the cord, the rate of growth and the duration of compression. In a typical case, a history of slowly developing compression, well localized, with a definite level of sensory disturbance, increased reflexes, spasticity and weakness of the extremities, are noted. Lipiodol injection preferably through cisterno puncture with patient in a sitting position and subsequent x-ray should reveal a block.

Craig[1] has shown experimentally by inserting an artificial tumor (Horsley's wax) extradurally in dogs, that the spinal cord becomes adjusted to slowly increasing compression. This would explain the periods of remission often noted in cord tumors. He also showed that the spinal cord continues to function even when reduced in size by compression. If no degenerative changes take place it can return to normal. Therefore, if dysfunction persists after operation it is

*Read before the St. Luke's Hospital Staff meeting, Duluth, October 18, 1934.

due to degeneration, the result of interference with the blood supply causing stasis, undernourished and edematous tissues. Spinal puncture should also reveal block and this should include protein determination, anything above 45 mgm. being abnormal; the blood examination should elimnate pernicious anemia and lues.

We assume that the lesion was intramedullary and probably glioma because of the findings indicating rather diffuse involvement of the cord. The spastic paraplegia indicated involvement of the lateral columns; the sensory level involvement of dorsal columns; while weakness of quadriceps suggested some involvement of anterior horn cells; clonus and dorsiflexion of the toe, involvement of pyramidal tract.

Tumors of the spinal cord include all tumors which may press upon the cord as well as those which originate in it. Therefore, they may arise from the bone, from the connective tissue, and blood vessels about the dura, from meninges, the nerve roots (intraspinal) and in the cord itself.

Anatomically the cord is about sixteen and one-half to eighteen inches long and about one cm. in diameter except at the cervical lumbar enlargements.[2] It is quite evident from a cross section that a tumor need not enlarge greatly before compression occurs.

The cord is movable laterally and can be rotated. It can be moved up and down in the canal about one inch. It is, therefore, capable of displacement.

As I stated before, this case is quite typical. We have seen several cases which we considered as being sclerosis of the spinal type, and which later proved to be cord tumor. We came to the conclusion that when we made a diagnosis of sclerosis of the cord involving the spinal segments this should be a cardinal symptom of cord tumor—at least it should be suspected.

I can remember another patient who came into our offices several years ago. He had had an operation for gallbladder disease and appendicitis several years before. Later he developed symptoms of multiple sclerosis, and rather than subject him to further hospital expense here we arranged for free hospitalization elsewhere. On the way down, he developed a transverse myelitis in the middorsal region and a diagnosis of cord tumor was made.

He was operated upon and what was thought to be a hemangioma was discovered. X-ray therapy was used and the patient recovered rather completely for about six months and then unfortunately developed root pains and recurrence of neurological findings. X-ray of the spine revealed multiple myeloma.

This case illustrates the need of x-rays and physical examination of specific areas of the spine; the need of continued observation to observe progressive symptoms; the fact that bony tumors often cause cord symptoms and that a prior history of abdominal surgery is quite common in cord tumors due to root pains in this area.

Another case that I recall, which was reported by Dr. C. E. Alexander as multiple neurofibrosarcoma, illustrates the necessity of continued observation for progressive neurological findings. This patient had a complete transverse lesion and was being observed in a hospital elsewhere and, since he did not improve, he finally consulted a miracle man—who wheeled him out to view the moon one night and to work his miracles.

On his return he was surprised to note that he was able to walk. At post mortem here, several years later, this was easily explained, when a walnut sized pedunculated neurofibroma of a posterior root was extruded outside the canal and this miraculously was extruded on the occasion of his trip to view the moon with the "miracle man."

Treatment is laminectomy with wide exposure of the cord, the common error being that exposure is not high enough. Extradural tumors and extramural intradural tumors can often be removed entirely with good results. Most often intramural tumors are of a glioma group and decompression is all that is accomplished. X-ray treatment in this group is beneficial.

The prognosis, of course, depends upon the removability of the tumor and is better in extramedullary non-malignant tumors than in intramedullary tumors. It depends upon several factors, namely, the nature of the growth, extent of the cord compression, duration of cord compression and the rapidity with which compression was applied; most of all whether degeneration of the cord structure has taken place, and here, as is well known, there is no regeneration. For this reason the prognosis of each case must be worked out on its merits. The prognosis in the extramedullary intradural tumors is more satisfactory than in any other large group of cord tumors.

In intramedullary tumors, as in our case, recovery is slow and seldom complete. In some cases the tumor is encapsulated and extrudes itself if the cord is cut over it. In others, as in our case, the tumor tissue invades the cord structure. It is quite surprising to note the number of cases which will recover sufficiently to be useful, though partially disabled, citizens for many years. Complete recovery is not to be expected and evidence of recurrence at sometime, even though delayed, should be anticipated.

Conclusions

1. One should suspect cord tumor if there is evidence of progressively increasing defect of nervous function limited to the spinal segments.

2. Operation, even if only a decompression, as in the case reported, often results in great improvement.

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EDITORIAL

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BUSINESS MANAGER
J. R. BRUCE, Saint Paul

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New Tests of Hepatic Function

Of the large number of tests for hepatic function which have been proposed for clinical use, many are open to objection because of the cost and technical difficulty of the procedure, and also because the information gained in certain types of hepatic disease is not always sufficiently conclusive to repay the effort of doing the test. Two new tests which have recently advanced appear to be of particular promise, since they are easily performed and provide information which is not supplied directly by other tests now in general use.

The first of these tests, known as the Takata reaction, is used to detect the presence of extensive parenchymatous hepatic damage. It is done in very much the same manner as the colloidal benzoin test on spinal fluid, and, like this test, appears to depend upon the amount and character of globulin present in the fluid examined. The technic is extremely simple; various dilutions of serum are added to tubes containing a mixture of mercuric chloride and sodium carbonate in solution. In the presence of diffuse hepatic damage, flocculation occurs, a phenomenon which depends, according to Jezler, on the fact that if the proteins of the serum or ascitic fluid in question are altered, they lose their protective action on the colloidal solution of mercuric oxide formed by the interaction of previously mentioned salts.

It is a well established fact that the proteins of serum are altered in hepatic disease, as many investigators have shown. There is commonly a moderate reduction in the total protein and a reversal of the albumin-globulin ratio, the total globulin content being increased at the expense of the albumin fraction. In a series of cases studied at The Mayo Clinic, the correlation between such increases in the globulin content and positive Takata reactions has not been striking, but the latter test has been almost uniformly positive in the presence of advanced parenchymatous hepatic injury. Similar results have been obtained by Heath and King, Tumen, and numerous continental investigators. The lack of correlation between the globulin content and the positive Takata reaction is at some variance with the theory on which the latter test is based; possibly one can postulate some change in the structure of the serum proteins to explain such results. The clinical value of the test, however, seems quite definite. The blood serum or ascitic fluid in various types of parenchymatous hepatic disease produces flocculation, while negative results are obtained in metastatic maligancy of the liver and in other conditions in which the hepatic cells are not diffusely affected. The test promises to be of considerable value in the study of unexplained ascites, in the detection of the cause of gastro-intestinal bleeding, and in determining the nature of hepatic enlargement. It should be particularly useful in the latter field, since metastatic lesions of the liver may simulate cirrhosis very closely, and the commonly used bromsulphalein test does not differentiate the two conditions.

The second test is based on the ability of the liver to detoxify benzoic acid by conjugation with glycine to form hippuric acid. First devised by Quick, this test has now been used sufficiently to give a fairly good idea of its value. The method is simple and consists of gravimetric de-

termination of the total hippuric acid in the urine for four hours after the oral administration of a dose of sodium benzoate. A reduction in the synthesis of hippuric acid indicates hepatic damage. Positive results have been obtained in portal cirrhosis, in splenic anemia, and in syphilitic hepatitis. In such cases the degree of hippuric acid excretion is quite closely correlated to the degree of bromsulphalein retention and to the changes in the serum proteins previously mentioned. In intrahepatic jaundice the test appears to give a better idea of the degree of hepatic damage than the more generally used galactose test, but its greatest field of usefulness appears to lie in the study of so-called surgical types of jaundice. In such cases, any test of hepatic function based on the excretory capacity of the liver is of little value, and tests which involve the metabolic functions of the liver are subject to a number of sources of error.

The hippuric acid test, however, is not open to any of the foregoing objections and appears to give reliable information as to the degree of hepatic damage present, as shown by studies at operation and at necropsy. It should be noted that the test does not propose to differentiate between obstructive and intrahepatic jaundice, but only measures the amount of functioning hepatic tissue as shown by the amount of glycine which the liver can furnish for the synthesis of hippuric acid. In clinical use it is necessary to be certain that renal insufficiency is not present, since renal lesions reduce the rate of elimination of hippuric acid and may give false positive tests. In a recently studied series, it seemed that the hippuric acid test gave a good idea of the actual state of the liver and its ability to withstand surgical procedures. While both positive and negative errors were noted in this group, the average accuracy was high.

These two tests should be a welcome addition to the armamentarium of the practitioner whose laboratory facilities are limited and who wishes to obtain information with regard to the state of the liver at a minimal expenditure of money and effort.

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Canucks and Yanks Meet

The Canadian cities at the Head of the Lakes, Fort William and Port Arthur, entertained (May 25 to 29) a joint meeting of the Ontario and Manitoba medical societies. Invitations were extended to many Minnesota and Wisconsin doctors to attend, and not a few took advantage of this fine international gesture. From Duluth, Drs. E. L. Tuohy, W. A. Coventry, K. R. Fawcett, D. L. Tilderquist, and T. J. O'Leary of Superior, Wisconsin, made up one party; Drs. T. L. Chapman, A. E. Hedberg and E. F. Loewen made up another; Drs. B. A. Smith and S. S. Shannon of Crosby were observed in the gathering, and there were likely others missed by your scribe.

The program was well planned and Dr. McCullough's local committee functioned with unusual success. A group meeting at the American Head of the Lakes is being planned for this autumn.

The North Shore boulevard drive is now in almost perfect condition. Few drives of such length combine a like degree of grandeur, charm and historical interest.

An unusual interest has been evidenced this year in the A. M. A. meeting in conjunction with the Canadian Medical Association at Atlantic City. The medical, as well as the social and economic problems, are so identical that it is only natural that closer and closer relationships should be cultivated.

It is noteworthy that a revival of the automobile industry (with flashier, brighter and more economical models) finds more and more doctors combining attendance at medical sessions, far and near, with vacational treks. This gives scant comfort to the railroads, and, despite an earnest effort on their part towards increased speed and economy, up to date the automobile combines a flexibility and comfort that not only gets the traveler to his destination but renders him and his family mobile units when they get there.

E. L. T.

Great Leader

The death of Dr. Herman M. Johnson of Dawson brought to a close a picturesque and unique career. It also marked the end of a great era in medical organization in Minnesota.

When Dr. Johnson first became a power in Minnesota, the Minnesota State Medical Association was a weak, loosely linked aggregation of county scientific societies. It held no significance whatever in legislative councils. It assumed no responsibility for leadership in the protection of the public health. The door was wide open to any form of quackery or medical preying upon the public in Minnesota.

When Dr. Johnson died at his home in Dawson last month, he left a powerful and closely knit organization of physicians. He left a model of basic science legislation on the statutes for the protection of the public against medical fraud, a piece of legislation which he has personally protected against infringement at each session of the legislature since its passage in 1927. He left united front among his fellow physicians in the state against interference of unqualified agencies and persons between the physician and his patient, against deterioration of medical standards, against crippling of the physician in his constant search for more knowledge and better equipment in the treatment of disease.

All this has come about in a period of approximately ten years and if it can justly be said to be the contribution of any one man, certainly major credit must go to Dr. Johnson. It was he who taught the doctors of Minnesota the effectiveness of organization. It was he who showed them how to use it.

Dr. Johnson died at the end of a strenuous and highly important legislative session. A report of the effective work of his committee was assembled and presented to the House of Delegates at the annual meeting of the Association in Minneapolis, last month. At the very moment of his death he was making plans for further negotiations with relief officials of the state.

Dr. Johnson will be sadly missed in Minnesota. But the organization which he envisioned and helped to establish will go on. It is shaped and ready, now, to attack new problems. The vigor and single heartedness with which it fills its new rôle will be a sufficient testimonial to the memory of "Herman."

TRIBUTE TO DR. HERMAN M. JOHNSON

We who have lived for over half a century are due from now on to find ourselves more and more lonely with every passing year. Those whom we have known and loved, with whom we have been associated in work and relaxation and from whom we have received encouragement in hours of defeat and disappointment, in whom we have reposed confidences and from whom we have sought counsel when the road ahead seemed uncertain are taking leave of us, one by one. The circle is becoming smaller, the line thinner. That is the penalty we pay for living on, the price the Reaper exacts for forbearance.

For nearly thirty-four years Doctor Herman was my friend. When I was a young man of eighteen he became my mentor. He never failed me. He never broke faith. He never gave me bad advice. He never refused assistance when it was needed—in fact, he gave it without being asked.

He was the very soul of honor. If there was any alloy of base metal in his character, I did not find it. I never knew him to make a promise he did not keep. He was direct, outspoken, sincere. If he ever lacked in tact, it was because he was so honest that he preferred to tell the truth even when it hurt, rather than to keep silent and have his own conscience accuse him of insincerity.

He was a man of strong convictions. What he believed, he believed sincerely; what he felt, he felt deeply. To him there was never any uncertain shading between right and wrong.

He had keen perception and an analytical mind. The ability to note symptoms and diagnose causes, to trace effects to their source, which made his professional career notable and in many respects exceptional, he carried into fields outside that of medicine. Ofttimes I have been with him when, as with a surgeon's skill, he dissected the social body and probed for the causes of its ailments. When so engaged he showed that mingling of courage and caution that characterizes the true scientist, whether he works in the library, the laboratory, or the operating room.

While Herman was not without honor in his own community, I doubt whether those who saw him every day realized fully the high esteem in which he was held in the world outside, and

especially among the national leaders of his profession. Indicative of the wide recognition accorded him and of the large circumference within which he was known, is the fact that I first heard of his death, not from the telegram which I received from Dawson, but from a group of eminent physicians meeting in Washington.

The old home town will never be quite the same again. One figure I will miss on Main Street, in his office and in places of business—the figure of a modest man who carried his honors lightly, of an honest man who spoke candidly, of a friendly man who was really interested in his neighbors and associates, of a truly Christian gentleman who without professing any particular piety exemplified in his daily life his faith and conviction that "it is better to give than to receive."

EDITOR'S NOTE: The above tribute, written by Congressman Theodore Christianson and sent to Mrs. Herman Johnson, is reproduced because it tells so well what one of Dr. Johnson's close friends thought of him.

In Memoriam

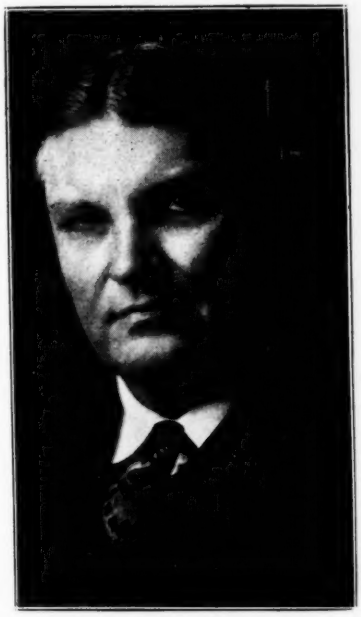
Herman M. Johnson
1874-1935

Dr. Herman M. Johnson, surgeon and mayor of Dawson, Minnesota, died at his home from gall-bladder complications following a week's illness on June 19, 1935.

Herman M. Johnson was born at Pelican Rapids, Minnesota, sixty-two years ago. He received his medical degree at the University of Minnesota and served his internship at the Norwegian Deaconess Hospital, Minneapolis. After one year's practice at Grafton, North Dakota, he moved to Dawson, Minnesota, in 1903. Following a brief period of practice he took postgraduate work at Johns Hopkins medical school, returning to Dawson, where he has since practiced.

Dr. Johnson was appointed chairman of the Committee on Public Policy and Legislation of the Minnesota State Medical Association in 1924, a chairmanship which he has held since that time except for the year 1926, when he was president of the State Medical Association. The passage of the Basic Science Law by the State Legislature was the result of his efforts more than those of any other one man. His activities on the Legislative Committee during the past ten years in preventing ill advised legislation have been even more valuable. Since 1929 Dr. Johnson has been a State Delegate to the American Medical Association and his experience in medical organization was nationally felt.

Besides being a member of the Camp Release District Medical Society, the State and American Medical Associations, Dr. Johnson was a member of the American College of Surgeons and last May was made an hon-



DR. HERMAN M. JOHNSON

orary member of the Hennepin County Medical Society.

Dr. Johnson is survived by his widow, three sons, Harold, Wilhelm and Reginald, and a brother, Dr. Carl Johnson, with whom he practiced.

M. J. Miller
1910-1935

Dr. M. J. Miller and his wife tragically met death May 30, 1935, when the automobile in which they were riding went off the road and toppled into the Mississippi River near Grand Rapids, Minnesota.

Dr. Miller was the son of Dr. H. A. Miller of Fairmont. He was born at Fredericktown, Missouri, November 30, 1910, and graduated from the Waseca high school in 1928. His premedical course was taken at Western Union College at Le Mars, Iowa, and he obtained his medical degree from the University of Minnesota in March, 1935. His internship was completed at the Minneapolis General Hospital January 1 of this year and he served as resident physician at St. Luke's Hospital in Saint Paul for the first four months of the year.

On January 13, Dr. Miller married Florence Vrantzen of Minneapolis and the couple moved to Pine River the middle of May. Dr. Miller had thus been engaged in practice but two weeks when the accident terminated the career of both himself and his wife.

MEDICAL ECONOMICS

Edited by the Committee on Medical Economics
of the
Minnesota State Medical Association

B. J. Branton, M. D.
J. A. Moga, M. D.
W. F. Braasch, M. D., Chairman
J. C. Michael, M. D.
A. N. Collins, M. D.

Great Meeting

The 82nd Annual Meeting is in progress at the Minneapolis Auditorium as this issue goes to press.

In size and scope and scientific variety this meeting greatly outstrips any in the history of the organization.

Registration at this early date shows that there is an undoubted place for a great annual meeting of sectional rather than of state interest in the Northwest.

High lights of Council and House of Delegates proceedings will be in these columns next month. Watch for them.

Trend of Legislative Opinion

Several interesting observations recently made by Dr. E. H. Cary of Texas, chairman of the Legislative Committee of the American Medical Association, are deserving of special note.

The Committee found, for instance, that a "definite impression prevailed in the minds of the president and others that the body of the profession as represented in the membership of the American College of Surgeons was committed to sickness insurance."

In talking with official Washington and particularly with representatives of the President's Committee on Economic Security, the Committee made a special effort to point out that the facts were otherwise, and to correct that unfortunate impression. (Note below Dr. Cary's report of a new policy with regard to these matters announced by the College of Surgeons.)

The final report of the President's Advisory Committee on Health Insurance had not even yet been written when Dr. Cary reported to the House of Delegates. It awaits the conclusions of the chief statistician.

Health Insurance

A legislative year which saw the first concerted attempt to enact legislation for compulsory health insurance is about to end with compulsory, contributory health insurance still unrealized. It is no nearer, certainly, than it was a year ago and popular feeling is not now so ardent as it was for sweeping changes in our social structure.

The iron was hot six months ago. When the opportunity comes to strike again it is altogether probable that the iron will have cooled in the interval.

Compulsory sickness insurance will not be pressed in this or very likely in the next session of congress, the Committee was told. It is possible that a bill may be presented, however, as a sort of "trial horse" to get the public reaction.

Legion Keeps Faith

Dr. Cary's Committee was particularly pleased to report that its conference and coöperation with representatives of the American Legion have borne fruit.

In a series of meetings the Legion repeatedly assured the Committee that it did not and would not advocate further hospital building for veterans beyond caring for special needs, jointly agreed upon, here and there.

The large number of bills introduced for care of veteran patients did not emanate from the American Legion and were not sponsored by Legion representatives.

Problems in Medical Relief

No definite changes appeared to the Committee to be contemplated immediately in the plan for medical care of the indigent.

The question of what agency is to distinguish, in the future, between the employables and the non-employables among those on relief is apparently still under discussion.

The United States Public Health Service might be assigned the task according to the Committee. A very elaborate plan has been worked out which, even under sympathetic administration, might well aid in promoting and establishing a health insurance system.

Officials were not in agreement as to whether this would, in fact, be the solution, however. In another department, still another plan which leaves out the public health service and assigns the task to local agencies was suggested. This plan seemed to the Committee to be far less disturbing.

Conclusion: "As a Committee we are hopeful of the future but do not deny that the next two years will require of you your active support in defending the principles you have outlined and the ideals which you cherish."

The College of Surgeons Conforms

A change of policy regarding the solution of economic problems has been adopted by the Board of Directors of the American College of Surgeons, Dr. Cary announced to the House of Delegates of the American Medical Association at Atlantic City.

As a result of the recent conference of representatives of the College of Surgeons and of the American Medical Association, the College announced that it would hereafter leave the solution of economic problems to organized medicine and its various branches and that it would in the future devote itself exclusively to the special problems to which it is dedicated.

The medical profession as a whole will undoubtedly applaud this action of the College of Surgeons. It will be recognized as logical and proper and a guarantee against unfortunate misunderstandings in the future as to the solidarity of the profession.

It is to be hoped that other special societies will adopt similar policies.

Important!

(The following interesting announcement came from SERA headquarters in St. Paul just as this issue went to press.

The Schedule of Monthly Earnings printed below it is taken from a pamphlet just issued by the Works Progress Administration in Washington called "Preliminary Statement of Information for Sponsors," Circular No. 1.

Further information about this new development in the handling of relief in Minnesota will be printed in these columns next month.)

A change in the method of handling the relief of indigents in Minnesota and in the balance of the nation is impending and with that change will come a sizeable—perhaps drastic—reduction in the amount of medical aid granted through County Relief Offices.

In the new employment program, which will be called "Works Progress Administration," employed persons now on relief rolls will be given jobs on socially desirable and feasible projects at a definite wage rate.

These persons will not receive any type of supplementary aid from the present relief administration. Among other things this means that families receiving benefits of the new employment program must care for their own medical needs out of the wages which they earn. Such persons, if they need medical care, have the same status as any other private patient of the physician serving them. The County Relief Office will be unable to assume any responsibility for the needs of relief clients who obtain jobs under the new employment program.

In a word, this means that physicians who have formerly been receiving authorizations to care for indigents in their community may expect a drop in the number of such authorizations quite directly in proportion to the speed with which employed relief clients are placed on WPA projects.

The following table shows the established rates of earnings for use in preparing project estimates.

Schedule of Monthly Earnings

	Counties in which the 1930 population of the largest municipality was—	Region I	Region II	Region III	Region IV
Over 100,000	Unskilled work	$55	$45	$35	$30
	Intermediate work	65	58	52	49
	Skilled work	85	72	68	68
	Professional and technical work	94	79	75	75
50,000 to 100,000	Unskilled work	52	42	33	27
	Intermediate work	60	54	48	43
	Skilled work	75	66	62	58
	Professional and technical work	83	73	68	64
25,000 to 50,000	Unskilled work	48	40	29	25
	Intermediate work	55	50	43	38
	Skilled work	70	60	56	50
	Professional and technical work	77	66	62	55
5,000 to 25,000	Unskilled work	44	35	24	22
	Intermediate work	50	44	36	32
	Skilled work	63	52	48	42
	Professional and technical work	69	57	53	46
Under 5,000	Unskilled work	40	32	21	19
	Intermediate work	45	38	30	27
	Skilled work	55	44	38	35
	Professional and technical work	61	58	42	39

Regions include the following States:

I. Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

II. Iowa, Kansas, Missouri, Nebraska, North Dakota, South Dakota, Delaware, District of Columbia, Maryland, West Virginia.

III. Arkansas, Kentucky, Louisiana, Oklahoma, Texas, Virginia.

IV. Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee.

New Plans

One of the outstanding features of the recent meeting of the House of Delegates of the American Medical Association at Atlantic City was the Special Report read by Doctor Leland of the Bureau of Medical Economics. Most of his suggestions were described in the Medical Economics columns of the last number of MINNESOTA MEDICINE. In response to requests made by the House of Delegates at the special session last February, he made a thorough study of nearly two hundred different experiments in medical services conducted by county medical societies throughout the United States. He found that the experiments were so diverse and varied so widely that not only classification, but enumeration was difficult. In this report, however, complete enumeration is made insofar as possible, as well as tentative classification. He found that it was not possible to make all county medical society plans conform to a single pattern, but that they must be adjusted to local necessity. To quote from his report, he states that:

"These plans involve in general the following steps:

1. Study of local medical facilities to determine the nature and extent of medical problems for which adjustment is needed.
2. Definition of persons or income groups for whom medical benefits should be provided.
3. Method of determining patient's ability to pay.
4. Amount and nature of medical service to be provided.
5. Organization and coördination of community medical services, supplemented by new units of administration when necessary.
6. Systematic movement of applicants for medical care.
7. Manner of presenting a plan to the public and method of securing members.
8. Method of making collection or receiving payments for medical care.
9. Method of remunerating physicians for

their services to patients receiving benefits under the plan.

10. Administrative details."

A short résumé of many of the county society plans was included, and would give any society contemplating any new set-up an idea as to what plan their group might be able to use. He calls attention to some of the dangers involved: (1) The possibility of stimulating counterfeit plans by irresponsible people, (2) Danger that the public may be educated to the false belief that good medical care can be furnished for too low sums. Even the most enthusiastic advocates of compulsory sickness insurance have been forced to recognize that it is not possible to furnish a good medical service for less than $30 per person per year, or somewhat in excess of $100 per family per year. (3) The danger of adopting an undesirable plan which it would be impossible to change later, and which may become a pattern for wider plans in the future.

Copies of the Special Report are available through the offices of the State Secretary, and it is to be hoped that every member will be interested enough to read this report thoroughly.

Report of the Judicial Council

Another outstanding feature of the meeting of the House of Delegates was the report of the Judicial Council, presented by Dr. George E. Follansbee. Under the heading of "Improved methods of administering the principles of medical ethics," Dr. Follansbee called attention to the fact that the Judicial Council in the past has made recommendations which have resulted in improved conditions under which medical service is made available to the public. Reference especially is made to discussions and pronouncements of all kinds of *contract practice*, whether by individual or grouped physicians, hospitals, dispensaries, teaching institutions, or insurance or industrial companies. It is apparent that the very democracy of our existing set-up may become involved unless our county and state societies rapidly develop to meet adequately local situations arising from the professional activities of a small but thoughtless or indifferent section of their members. If the societies will not exercise their prerogative or discharge their duties in this connection, it will become advisable to extend the disciplinary functions now resting in the county society to the state association and possibly to the national administration.

"Ordinarily," says this report, "under present by-laws of county, state and national associations, procedure to correct an unethical practice must be instituted in the county medical society by the preferring of charges, which, in practice, is left to some individual who feels aggrieved. Few individuals feel it their personal responsibility to prosecute a breach of ethics that affects them but little personally, though it may affect the profession of medicine in a major degree. The institution of charges by an individual in such cases of general concern might very probably amount to professional suicide. Seldom does any individual desire to place himself on his own initiative in the position of prosecutor for the benefit of the profession as a whole. In so doing he is likely to bring upon himself the unfriendliness and antagonism or colleagues often in influential positions."

Impartial Courts

"Society has found that it needs a system representing society as a whole, of grand jury investigation and indictment, a public prosecutor, and an impartial court with the right of appeal to higher courts. Medicine in this age needs a similar system for enforcement of its ethical and economic principles. Such a system of medical jurisprudence is needed most and would be applicable in the larger county medical societies. The body bringing the indictment and the prosecutor would lose their personal identity in their representation of the medical profession as a whole. No stigma, but rather honor, would attach to them.

"The Principles of Medical Ethics, while followed by the large majority of the profession, are looked upon only as a theory by some in the profession and considered—if considered at all —by many not in the profession as simply a uniform to be worn while 'on parade.' When people, laymen as well as members of our profession, realize that the Principles of Medical Ethics are the basic principles of honest, fair dealing and that their observance is necessary to the best interests of the whole people, laymen as well as members of the profession, medical practice will have taken a long step upward.

Medicine will have more dignity and authority, and people will be better served."

It is obvious that if violations of medical ethics, particularly in relation to various forms of contract and allied practice, can be justly and adequately dealt with, organized medicine will have solved one of its greatest problems. It will have made a distinct advance.

Teaching Economics

Out of 71 Class A medical schools of the country 60 already have established or are planning to establish compulsory medical economics courses for their students.

This is the figure reported to the House of Delegates at Atlantic City by the Philadelphia medical society in a resolution urging that the Council on Medical Education and the Bureau of Medical Economics persist in their efforts on this score until medical economics courses have been established in all medical colleges in the country.

It is interesting to note, in this connection, that, through the efforts of the Minnesota State Medical Association's Committee on University Relations and particularly of President W. A. Coventry, a course in medical economics will be required for the first time next year for Minnesota medical students.

Dean R. E. Scammon has appointed a committee composed of representatives from the State Medical Association and the faculty of the Medical School to arrange for such courses during the ensuing year.

The importance of this departure in the formal preparation of young men for the practice of medicine cannot well be overestimated.

It is a recognition of the fact that the young physician needs more than a scientific education to make a place for himself in this complicated modern world.

The object is not to make a business man out of the doctor. It is to make doctors who comprehend clearly the place of medicine, its obligations as well as its prerogatives in our social structure.

New Society

The Dakota County Medical Society is now in the process of organization.

It enters the affiliated societies of the Minnesota State Medical Association as the 34th member of the group.

The following physicians become charter members of the society: Dr. J. A. Sanford, Farmington; Dr. G. F. Walter, Farmington; Dr. L. D. Peck, Hastings; Dr. L. R. Peck, Hastings; Dr. L. S. Burns, South St. Paul; Dr. K. E. Stein, Lakeville; and Dr. H. A. Fasbender, Hastings.

Dr. Stein is transferring his membership from the Scott-Carver Society and Dr. Fasbender from the Hennepin County Society.

Organization in Dakota county has been under consideration for years. The eight physicians who are now organizing their society are to be congratulated upon their enterprise and their community spirit.

The county medical society is the most important unit of medical organization and also the best guarantee of good medical service in any community.

Minnesota State Board of Medical Examiners

St. Paul Woman Sentenced to Five Years at Shakopee on Manslaughter Charge

Court Dismisses Similar Charge Against St. Paul Physician

Re: State of Minnesota *vs.* Emelie Arnold
Re: State of Minnesota *vs.* George H. Burfiend, M.D.

On June 19, 1935, the Honorable Richard D. O'Brien, Judge of the District Court, sentenced Emelie Arnold, 50 years of age, to a term of not to exceed five years at the State Reformatory for Women at Shakopee. Mrs. Arnold had entered a plea of guilty on June 10, 1935, to a charge of manslaughter in the first degree following the death of Miss Edna Beaman, seventeen years old, Dawson, Minn.

Mrs. Arnold was placed under arrest May 14, following the death of Miss Beaman at the West Side General Hospital on May 13. At the time of her arrest Mrs. Arnold gave a statement to the County Attorney's office in which she implicated Dr. Burfiend. Dr. Burfiend was placed under arrest following the signing of a complaint by the father of the girl. Dr. Burfiend waived his preliminary hearing, was held to the District Court under bond of $5,000, which was furnished. He entered a plea of not guilty and a trial was had before a jury and Judge O'Brien. Mrs. Arnold testified for the State against Dr. Burfiend. The girl who accompanied Miss Beaman to the home of Mrs. Arnold and to the office of Dr. Burfiend, also testified for the State. Medical testimony was introduced to show that

death resulted from general peritonitis. There was testimony that the deceased had been recently pregnant and that the uterus had been recently emptied. When the state rested, the defendant made a motion to dismiss, which was granted by the Court. The Court was of the opinion that Mrs. Arnold and Elsie Toombs, witnesses for the State, were both accomplices and under the law no conviction could be had on the uncorroborated testimony of the accomplices. The case was tried for the State by Mr. James F. Lynch and Mr. William Desmond of the County Attorney's staff. Dr. Burfiend was represented by Mr. Thomas McMeekin.

OF GENERAL INTEREST

Dr. Halbert L. Dunn, director of the University of Minnesota Hospital, will leave the University July 15 to become chief statistician in the division of vital statistics in the Department of Commerce in Washington. Dr. Dunn became superintendent of the University Hospital in 1932, succeeding Paul W. Fesler, who resigned to become head of the Wesley Memorial Hospital at Northwestern University, Evanston, Illinois. Dr. Dunn graduated from the University of Minnesota in 1922, later became associate professor in the School of Hygiene at Johns Hopkins University, and later head of the Department of Statistics at the Mayo Clinic.

Dr. Edward J. Engberg, Saint Paul, has been appointed by the Governor to the State Board of Health to fill the vacancy left by the death of Dr. Helen H. Heilscher of Mankato.

UNIVERSITY NEWS

At the June meeting of the Board of Regents of the University several changes were made in the faculty of the Medical School. Dr. Richard E. Scammon, Dean of Medical Sciences at the Medical School for several years since his return from the University of Chicago, has been honored with a distinguished service professorship. Dr. Harold S. Diehl, director of the Student Health Service at the University since 1921, has been appointed to succeed Dr. Scammon as Dean of Medical Sciences. Drs. L. A. Buie, T. B. Magath, Wallace H. Cole and Arthur A. Zierold were promoted to full professorship and Drs. L. T. Austin, J. A. Bargen, V. S. Counseller, C. F. Dixon, P. S. Hench, H. Montgomery, L. M. Randall, H. D. Smith and R. M. Snell from assistant to associate professorship. Drs. L. A. Brunsting, H. K. Gray, F. J. Heck, R. M. Hewitt, C. W. Mayo, L. E. Brickman, G. J. Thompson and R. M. Lovell of Rochester were promoted from instructorship to assistant professorship. Mr. Ray M. Amberg, Saint Paul, connected with the University Hospital since 1922, was named acting director to succeed Dr. Halbert Dunn, who has accepted a government appointment at Washington.

REPORTS AND ANNOUNCEMENTS OF SOCIETIES

Annual Meeting

The combined meeting of our State Association with the Medical Section of the American Association for the Advancement of Science in the metropolis of the state, drew a record attendance—a record likely to stand for several years. The guest speakers drew enthusiastic audiences and the various demonstrations and exhibits proved instructive.

Next year the annual meeting will be held in Rochester, Minnesota, with Dr. W. W. Will of Bertha as president. Dr. W. A. Coventry remains in office until the first of the year. The House of Delegates elected Dr. E. G. McKeown, Pipestone, vice president, and Dr. C. W. Rumpf, Faribault, second vice president. Our efficient secretary, Dr. E. A. Meyerding, was re-elected and Dr. W. H. Condit, Minneapolis, was again chosen treasurer. Drs. Giffin, Sogge and Adams were re-elected councilors in their respective districts, and Dr. E. J. Simons, of Swanville, was chosen to fill Dr. Will's unexpired term as councilor in the Seventh District.

Dr. J. T. Christison, of Saint Paul, was-elected A.M.A. delegate, and Dr. E. A. Meyerding his alternate. The Council will appoint an A.M.A. delegate to fill the vacancy left by Dr. Herman Johnson as national delegate.

The Women's Auxiliary will have the following officers until the next annual convention Mrs. F. J. Elias, Duluth, president; Mrs. Ernest M. Hammes, Saint Paul, president-elect; Mrs. J. F. Norman, Crookston, first vice president; Mrs. W. B. Roberts, Minneapolis, second vice president; Mrs. B. R. Karn, Ortonville, third vice president; Mrs. A. C. Baker, Fergus Falls, recording secretary; Mrs. R. W. Josewski, Stillwater, treasurer; and Mrs. N. S. Dungay, Northfield, auditor.

Mississippi Valley Medical Society

The first annual meeting of the newly formed Mississippi Valley Medical Society will be held at the Loncoln-Douglas Hotel, Quincy, Illinois, on Oct. 2, 3, 4, 1935. A most practical program of intensive postgraduate instruction by eminent clinicians has been arranged. A preliminary program may be obtained from the Secretary, Harold Swanberg, M.D., 211-224 W. C. U. Building, Quincy, Illinois.

Minnesota State Board of Medical Examiners

The organization of the Board of Medical Examiners for the year beginning June 1, 1935, is as follows:

Dr. F. H. Magney (Duluth)—President

Dr. A. Fritsche (New Ulm)—Vice President

Dr. J. F. Du Bois (Sauk Center)—Secretary-Treasurer. (Office of Secretary—524 Lowry Medical Arts Bldg., Saint Paul)

Dr. A. W. Adson (Rochester)
Dr. C. L. Sherman (Luverne)
Dr. Ivar Sivertsen (Minneapolis)
Dr. Max Alberts (Saint Paul).

The new member of the Board, Dr. Max Alberts, was appointed by the Governor to take the place of Dr. E. J. Engberg (Saint Paul) whose term of appointment expired May 1, 1935. Dr. Engberg deserves the gratitude of the public as well as the medical profession for his efficient and devoted service as Secretary of the Board for the past five years.

Range Medical Society

The Range Medical Society met at Eveleth, Minnesota, May 23, when the following program was furnished by the staff of the More Hospital:

1. Review of Cases of Pulmonary Tuberculosis—Dr. M. L. Strathern.
2. Bronchitis, Pneumonia and Empyema—Dr. W. M. Akins.
3. Malignancy of the Lungs—Dr. F. R. Kotchevar.
4. Blastomycosis of the Lung, Silicosis, Pulmonary Abscess and Gangrene—Dr. E. N. Peterson.
5. Case Reports—Dr. C. W. More.

ANDREW SINAMARK, M.D., *Secretary*

Northern Minnesota Medical Association

Program

Monday—August 12, 1935
Duluth

Morning

Registration.
Fractures of Neck of Femur.
M. S. Henderson, Rochester, Minnesota.
Pelvic Inflammatory Disease.
John H. Moore, Grand Forks, North Dakota.
Selected subject.
L. R. Parson, Elbow Lake, Minnesota.
Lung Abscess.
E. N. Peterson, Eveleth, Minnesota.
Selected subject.
B. I. Derauf, St. Paul, Minnesota.
New Concepts of Calcium Therapy.
Richard M. Johnson, Minneapolis, Minn.
Luncheon and Business Meeting

Afternoon

Radiotherapy for Inflammatory and Malignant Conditions.
A. U. Desjardins, Rochester, Minnesota.
Fractures of the Ankle.
Owen W. Parker, Ely, Minnesota.
Selected subject.
J. C. McKinley, Minneapolis, Minnesota.
The Management of Diabetes Mellitus in General Surgery.
Clarence Jacobson, Chisholm, Minnesota.
Sterility, Its Etiology and Treatment.
James J. Swendson, St. Paul, Minnesota.
Report of the American Heart Association.
R. L. Nelson, Duluth, Minnesota.

Evening

Treatment of Pneumonia by Artificial Pneumothorax.
Edgar T. Herrmann, St. Paul, Minnesota.
Treatment of Acute Empyema.
Herbert A. Carlson, Minneapolis, Minnesota.
The Management of Malignant Disease of the Mouth and Adjacent Structures.
Gordon B. New, Rochester, Minnesota.
Medical Economics.
Dr. R. G. Leland, Director, Bureau of Medical Economics, Chicago.

Tuesday, August 13, 1935

9 A. M. Board steamer Noronic for trip up north shore of Lake Superior, returning to Duluth at 2 P. M. A five course dinner on the Noronic to be followed by addresses.
Chief speaker: Dr. Preston Bradley, Pastor of Peoples Church, Chicago, and President of the National Izaak Walton League.
Other speakers on the program:
Dr. W. R. Bagley, Duluth.
Dr. Irving Badeau, Brainerd, President Northern Minnesota Medical Association.
Dr. W. A. Coventry, Duluth, President Minnesota State Medical Association.
Dr. T. J. O'Leary, Superior, President Wisconsin State Medical Association.
Dr. R. G. Leland, Chicago.

O. O. LARSEN, M.D., *Secretary*,
Detroit Lakes, Minnesota.

Redwood-Brown County

The annual meeting of the Redwood-Brown County Medical Society was held at the Dakota Hotel, New Ulm, May 15. Annual elections were held and the following officers named: President, Dr. A. P. Goblirsch, Sleepy Eye; Vice President, Dr. C. A. Saffert, New Ulm; Secretary-Treasurer, Dr. Carl J. Fritsche, New Ulm; Censor for three years, Dr. E. J. Wohlrabe, Springfield; Delegate to 1936 State Convention, Dr. J. H. Vogel, New Ulm; Alternate Delegate, Dr. F. H. Dubbe, New Ulm.

Southern Minnesota Medical Association

The 1935 meeting of the Association will be held at Austin, Minnesota, Sunday afternoon and evening, and Monday, August 25 and 26.

Contributions to the program have been requested on the subjects of heart disease, gastric and duodenal disease, contagious diseases, mastoiditis, arthritis, prostatic hypertrophy and endocrine disorders, by Dr. N. W. Barker, Rochester, Chairman of the Program Committee.

AMINOACETIC ACID

The Council on Pharmacy and Chemistry reports that from the many studies reported on aminoacetic acid it is quite apparent that its use in the treatment of myasthenia gravis and muscular dystrophy of either the progressive or the pseudo-hypertrophic type offers the patient greater hope than any form of treatment heretofore employed. Its use in other conditions cannot as yet be recommended on the basis of the meager investigations thus far reported. The Council declared aminoacetic acid acceptable for New and Nonofficial Remedies. (J. A. M. A., April 6, 1935, p. 1239.)

PROCEEDINGS *of the* MINNESOTA ACADEMY OF MEDICINE

Meeting of April 10, 1935

The regular monthly meeting of the Minnesota Academy of Medicine was held at the Town and Country Club on Wednesday evening, April 10, 1935. The President, Dr. A. R. Hall, in the Chair.

The meeting was called to order at 8:15 p. m. There were fifty-seven members and one guest present.

Minutes of the March meeting were read and approved.

The President announced that the Executive Committee had discussed and approved a suggestion of having a social meeting of the Academy in June, and that Dr. Wilcox had offered his summer home at Rippleside for the meeting place. A motion was carried that such a meeting be held and that the Academy thank Dr. Wilcox for his offer.

The scientific program followed.

GROSS STRUCTURAL CHANGES IN THE ADULT HEART AND AORTA AS SEEN IN THE ROENTGEN RAY FILM AND THEIR CORRELATION WITH CLINICAL AND AUTOPSY FINDINGS

ALFRED HOFF, M.D.
Saint Paul

Dr. Hoff read his Inaugural Thesis with the above title. Numerous lantern slides of cases were shown. (To appear later in MINNESOTA MEDICINE.)

Abstract

The heart shadow contour gives valuable information in definitely diseased large hearts because with enlargement there is usually an accompanying change of form.

Although it merely reveals evidence of gross structural change which is usually impossible of correction, it does aid materially in the establishment of exact diagnosis and accuracy of prognosis which is so essential to the intelligent care of cardiac patients.

When estimating the significance of a shadow heart contour, the factors which normally influence its size and shape must be given due consideration. Such factors are: height, weight, race, age, the position and contour of the diaphragm and structural deformities of the thorax. Also, the divergency of the roentgen ray must be overcome by using a six foot film distance.

An attempt is made to illustrate by the shadow contour of the heart and great vessels alone, the changes occurring as a result of disease and to correlate this picture with the clinical and autopsy findings, when possible, without resorting to fixed cardiac measurements.

The cases shown are such as have been under personal observation for variable periods of time.

The normal shadow heart contour is explained with regard to the structures forming its left and right contours. These structures are so-called bows; the right auricular and the ascending aorta forming the right border, and the aortic knob, pulmonary artery, left auricle and left ventricle forming the left border.

General opinion usually holds, however, that, when the pulmonary bow or the left auricular can be definitely identified, the heart is abnormal.

Gross structural changes in the heart and aorta affecting these various bows independently and jointly, are shown by lantern slides, with cases, giving the history, clinical and postmortem findings.

1. The contours of compensated and decompensated mitral stenosis are illustrated and the mechanism of their production explained.

2. Moderate and marked pulmonary bow prominence, indicating a dilatation of the pulmonary artery and usually regarded as typical of a patent ductus Botalli, may be caused by a mitral stenosis and Ayerza's disease, while a patent ductus may exist with only a slight increased prominence of the pulmonary arc. Illustrative cases with autopsy findings are given.

3. Combined valvular disease. The type of contour is determined by the preponderating lesion present. Illustrative cases, with autopsy findings, are shown in combined mitral and aortic stenosis; combined mitral, aortic and tricuspid stenosis, and the triple combined with pericardial adhesions; also, of mitral stenosis associated with severe grade of hypertension.

4. Pericarditis with effusion. Illustrative case with autopsy findings, showing condition shortly after onset and subsequent massive effusion due to tuberculosis.

5. Contours of supracardiac shadow. Cases shown of (1) syphilitic aortitis; (2) aneurysm of ascending aorta with autopsy findings; (3) diffuse dilatation of the aortic arch, caused by atherosclerosis and syphilis, with autopsy findings.

The importance of the clinical history and progress with the impossibility of a differential diagnosis from the shadow contour alone, is stressed, in atherosclerotic and syphilitic dilatation of the aortic arch.

An attempt has been made to correlate, without resorting to set cardiac measurements, the roentgen-ray shadow contour of clinically observed large hearts in adults, with the clinical symptoms and autopsy findings, in an effort to appraise its merits in the diagnosis of the cardiac cases selected.

1. A knowledge of the significance of such contours permits the clinician to obtain rapid information with fluoroscope alone, and, by the use of the orthodiagram, a quick permanent record both of the heart shape and size.

2. It is particularly useful in the combined types of valvular lesions, where auricular fibrillation and congestive heart failure have changed the characteristic murmurs and obscured the type of heart failure.

3. The fluoroscopic screen permits of a rapid and accurate method by which a dilatation of the aortic arch or the pulmonary area can be determined.

4. It offers an accurate method for determining changes occurring in the size and shape of the cardiac outline during the progress of disease, being especially useful in pericarditis with effusion.

5. In determining cardiac function, it offers little help.

6. It may be said that the roentgen-ray shadow heart contour is a valuable accessory method in the diagnosis and care of heart disease when combined with the clinical symptoms, findings, and the electrocardiogram.

7. In those painful types of heart disease where, often, all methods of exact diagnosis fail, it is well to remember the advice of the elder Dr. Janeway, who, in discussing angina pectoris, said that, when he "disregarded the patient's story and relied solely on his own calm judgment, he usually made a mistake."

I wish to acknowledge my indebtedness to Dr. John F. Noble and Dr. Kano Ikeda for the autopsy record of these patients.

Discussion

DR. A. R. HALL (Saint Paul): I think we will all agree that this is one of the most instructive and nicely executed theses we have had. The correlation of the clinical history, the physical findings, the electrocardiogram, and autopsy findings with the different shadows of the heart contour brings out very well the diagnostic evidence which may be obtained from an x-ray study of the heart.

DR. CARL B. DRAKE (Saint Paul): I enjoyed Dr. Hoff's presentation very much. I was particularly interested in hearing Dr. Hoff state that it is impossible to make a definite differential diagnosis between an arteriosclerotic arch and a leutic aortitis from the x-ray shadow alone. I recently saw a patient whose ascending aorta appeared markedly widened in the x-ray film, but whose Wassermann was negative. Inasmuch as the Wassermann is not 100 per cent reliable, it is therefore not possible to make an accurate differential diagnosis in all cases.

Dr. Hoff referred to the bulge in the left border of the heart shadow which is usually considered typical in a case of mitral stenosis. I had always thought this bulge of the shadow was caused by a dilated left auricle. There is good reason to believe that this is not the case and that this prominence is the result of hypertrophy and dilatation of the right ventricle. I would be much interested in knowing Dr. Hoff's interpretation of this prominence in cases of mitral stenosis.

DR. S. MARX WHITE (Minneapolis): This very meaty presentation by Dr. Hoff tempts one to go perhaps too far afield, but, in discussing it, I should like to present two concepts and two methods I have been using with a great deal of satisfaction, to myself at least. They have helped in making more accurate the diagnosis of conditions in the heart and aorta, and in watching their progress. The first concept is that, in the regions where the heart and great vessels are covered by pericardium, the outline is in fact that of the pericardium. If one retains that concept it leads directly and at once to search for evidence of effusion or other material within the pericardial sac. True it is that when the pericarial sac contains no excessive amount of exudate or tissue, the cardiac outline itself is revealed. The second concept which seems to me of importance is that the so-called right border of the aorta as seen in the mediastinal shadow above the heart is practically never the right border of the aorta but has as a complement the shadow of the right innominate vein and superior vena cava. This venous shadow lying to the right of the aortic sinus may be very narrow or thin, and, if the veins are not dilated, the outline seen corresponds practically to the right border of the aorta. If, however, the innominate vein and superior vena cava are over-distended their shadow determines the form taken by the outline on the right, and may make up a considerable part of the width.

I am particularly in accord with Dr. Hoff's conservatism in the interpretation of these x-ray silhouettes so far as they contribute to our diagnosis of valvular lesions. The x-ray shadow reveals certain changes in the size and outline of the great vessels and of the chambers of the heart, but we do not see the valves. The changes seen may lead to inferences as to the valvular lesion causing the distention of a chamber or a vessel, but inferences are not diagnoses, even though the x-ray silhouette quite often makes up a large part of the data on which a diagnosis is founded. I emphasize this caution because it is too common for the roentgenologist to make a diagnosis stating a valvular lesion rather than the size and type of cardiac outline, and too common for the patient, the hospital clerk, intern or resident, and the physician to accept such laboratory diagnoses without giving them only a part in the summation on which a true diagnosis should be based.

In addition to the concepts outlined, there are two methods which I have found to be very useful. The first method is the use of the fluoroscopic shadow which, though somewhat simpler and not as perfect in its interpretability as the orthodiagram, takes much less time and gives valid records of progress from time to time in the same case. I had Dr. J. B. Carey devise a frame on which a fluoroscopic screen could be drawn out to a distance of five feet from the target. Drawing it out and making a careful outline with a glass pencil, then transferring that to tracing paper, gives a very good permanent record of the heart outline and size; also it saves the time necessary for an orthodiagram and the expense of an x-ray film. The second method to which I wish to refer was brought to this region by Dr. L. M. Rigler. It is a method of obtaining the width of the shadow of the aortic arch, by putting in the esophagus a bolus of thick barium-containing material. It gives a very useful impression of the actual aortic width measured from the left side of the aortic arch to the left side of the shadow of the barium-filled esophagus. The parallax is relatively constant, and the method very often gives usable evidence as to the diameter of the aorta at that point.

DR. C. B. WRIGHT (Minneapolis): This thesis emphasizes the importance of routine x-ray examination of the heart. Many men feel that the orthodiagraph is more accurate than the six-foot plate. Both procedures

give more information than either one alone. Repeated examination over a period of years may bring out interesting changes in appearance of the heart outline which are of value. How long it takes to develop the configurations characteristic of the lesion is important if we are going to use the shadowgraph to make a diagnosis of an early lesion. There is not much definite information on this point. The same author referred to by Dr. Drake, I think we mean Polesvki, claimed that as the right heart enlarges the heart rotates to the left and one sees the shadow of the right ventricle on the left side. This makes the lower part of the straight line on the left. As the left auricle enlarges it enlarges posteriorly and to the right and, where it is much enlarged, one sees the shadow of the left auricle extending out to the right side of the heart. This may become very large and be confused with a mediastinal growth.

DR. HOFF (in closing): I was very much interested in Dr. White's comment about the aorta and in Dr. Drake's question.

At Wenckebach's clinic in Vienna, Dr. Herman Rösler, who is now at the Massachusetts General Hospital, taught that as the left aurricle hypertrophies it becomes posterior, while the hypertrophy of the right ventricle rotates the heart to the left on its axis and what we see on the left border is the conus pulmonalis and not the left auricle.

The left auricle may be so enlarged as to be seen on the right heart border; so that there may be two curves, (1) the right auricle, above; and (2) the left auricle, below.

NON-OPERATIVE TREATMENT OF LOCALIZED PERFORATIONS OF THE DUODENUM*

OWEN H. WANGENSTEEN, M.D.†

Abstract

Perforation is one of the tragic complications of ulcer. Its occurrence demands immediate operation for closure of the perforation. The immediate and great disability, together with the intense rigidity of the abdominal muscles, serves to identify it. True surgical shock does not attend perforation. In cases observed some hours after the occurrence of perforation, the rigidity of the abdominal mucles is frequently considerably less, owing to the dilution of the irritant by secretion from the serous cells of the peritoneal surfaces.

The simplest operative procedure is the best, viz., mere closure of the perforation. Circumstances which will compel the performance of gastroenterostomy or gastric resection are most unusual. With the postoperative employment of gastric siphonage, slight obstruction, occasioned by the closure of an indurated pyloric ulcer, may be well controlled.

The factors which determine the mortality of perforation are (1) the delay intervening between its occurrence and closure of the leak. Cases operated upon within the first six hours are subjected to least hazard. After 12 hours there is a steadily mounting risk, which, after 24 hours, becomes formidable. (2) The size of the perforation. (3) The status of digestion at the time of perforation. (4) The general physical condition of the patient.

This report concerns four patients with late duodenal perforations, one of which was due to trauma (kick by horse), and the other three to ulcer; all healed under conservative management by suction applied to an inlying duodenal tube. The ulcer perforations were essentially late cases in which some localization had probably occurred; at the time of admission they presented diffuse abdominal findings and their general physical status was not good. They were not the mild "formes frustes" type of case described by Vaughn and Singer. Two of the patients recovered following the development of a subphrenic abscess. The third died 14 days after entry into the hospital of diffuse peritonitis. At the time of her admission the perforation had been present 28 hours. The temperature was 102.2° F. and the pulse rate 134. The traumatic case exhibited gas around the cecum and kidney, indicating that there had been gaseous escape from the retroperitoneal duodenum. He convalesced satisfactorily following the institution of gastric and duodenal suction.

During the past four years, four patients with the clinical picture of perforation due to ulcer, in whom no gas could be demonstrated below the diaphragms on an x-ray film taken in the erect posture, have been treated conservatively without operation. All came early, but it was felt that failure to demonstrate free gas in the peritoneal cavity indicated that the perforation had already become sealed off. These patients were all known to have ulcer, and in 1927 I had closed a perforation for one of them. An additional patient with a "formes frustes" type of perforation of more than 24 hours' standing, has also been successfully treated without operation.

Studies on pneumoperitoneum by Drs. Paine, Rigler, and the writer indicate that a very small amount of gas below the diaphragm may be visualized on a roentgen film exposed with the patient erect. Frequently 3 to 4 cubic centimeters may be definitely seen; occasionally 20 cubic centimeters has to be injected before it may be demonstrated between the liver or stomach and the diaphragm.

Dr. Bowers and the writer have established perforations in the antrum of the stomach in a number of laboratory animals (unsutured incisions one centimeter in length). If these punctures are made when the stomach is empty, it is survived in 100 per cent of the animals; if done when the stomach has food in it, the mortality is 86 per cent.

These observations suggest that the first therapeutic procedure to be employed in the treatment of perforation due to ulcer should be evacuation of the stomach contents with a duodenal tube. Then the perforations should be closed as soon and as simply as possible, continuous suction being employed after operation to keep the stomach empty. It is a good plan to take a film in

*Complete paper to be published elsewhere.

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the erect posture in any patient suspected of having ulcer perforation. In my experience, patients exhibiting no gas below the diaphragm may be treated safely by conservative means. Patients with the "formes frustes" type of perforation coming after 24 hours may also be treated conservatively without anxiety. Patients coming late with diffuse findings, but in whom the occurrence of localization is probable, are in my opinion more secure with conservative treatment than with operation. Patients with late perforation in whom leakage is probably still occurring, as indicated by the presence of a large pneumoperitoneum, should be subjected to operation despite the enormous risk, granting that their physical condition permits.

Discussion

DR. ARNOLD SCHWYZER (Saint Paul): Dr. Wangensteen's observations are very interesting. One of the points he raised was that he had never seen shock in perforated ulcer. This may surprise some men, but it is a fact, at least in the early cases. The late Dr. Deaver made this always a very strong point in differentiating between acute pancreatitis and perforating ulcer. In the latter the pulse is even bounding, while in an acute pancreatitis there is great shock with weak pulse and an agonizing distress, the patient sensing impending death. An important point brought out by Dr. Wangensteen's report is that a case of gastric or duodenal perforation can be quite advanced and beyond surgical help when we see it, and still we should not make an absolutely hopeless prognosis.

I recall a case of a man thirty-two years old on whom I operated in 1902. Three or four years before, he had been desperately ill from an acute perforation of an ulcer. Dr. Wheaton, who was then professor of surgery, was consulted but he declared the patient too far gone for any surgical attempt. The abdomen was like a drum and distended to its limits. The patient, however, did not die but improved slowly. When he later came to us he had been suffering from constant distress, retention and, at one time, a very severe hemorrhage. A gastroenterostomy relieved him and he lived for thirty years, dying two years ago from what was reported to be high blood pressure. The reason I mention this case is this: When we opened the abdomen three or four years after that severe illness, a picture presented itself which remained vivid in my memory. There were diffuse adhesions, especially of the omentum to the anterior wall of the peritoneal cavity, and hundreds of minute white nodules like a miliary tuberculosis. But, remembering the history of the case, we felt that this was due to a perforation of an ulcer and on microscopic examination were able to verify it. In some of the nodules we found a vegetable fiber, in others an oval vegetable cell, and in some nothing was seen. This was a pseudo-tuberculosis caused by the seeding in of gastric, or rather duodenal, content.

Thus we have here a case of perforation of an ulcer into the free abdominal cavity. The patient, an otherwise strong man of 32 years, though not operated upon and probably because he was not operated upon at that desperate time, made the grade and lived 30 years after our gastroenterostomy in comfort, about 34 years after the perforation of his pyloroduodenal ulcer into the free peritoneal cavity.

When a patient gets a perforation, especially of the duodenum, the amount of gastro-intestinal content is of course a considerable factor. The stomach is known to destroy the bacteria in the chyme, but it does not destroy all the bacteria. The coli group, the cholera bacillus, typhoid bacillus, and the bulk of the other germs are rendered harmless, but the staphylococci, albus, aureus, flavus, et cetera, are not destroyed. I saw cultures of staphylococcus aureus given a patient with a gastroenterostomy, and the contents of the stomach, after plugging the opening for a proper time, contained the staphylococci in large quantities. All this refers to a normal gastric juice with normal or high acidity.

DR. C. B. WRIGHT (Minneapolis): Dr. Wangensteen's suggestion that a perforation of the stomach when it is filled may be more dangerous and increase the risk, suggests to me one of my earliest cases in practice, a servant girl seen in 1904. She had had "neuralgia" of the stomach. Shortly after eating a hearty breakfast she started to walk upstairs, suddenly cried out in pain and fell in complete collapse. I saw her very soon, within thirty minutes. She apparently was in shock, very pale, rapid thready pulse, cold perspiration, and had a subnormal temperature. She was sent to the hospital and operated on within the first two or three hours. She had an anterior wall perforation as large as a dollar and the entire content of the stomach was in the peritoneal cavity. Dr. Ringnell operated and closed the perforation with mattress and purse-string sutures and washed out the peritoneal cavity with gallons of salt solution. The stomach contents showed meat, potatoes, and bread and butter, and undoubtedly could not all have been eliminated. The abdomen was closed and she recovered, although her convalescence was slow and complicated by phlebitis in one leg, an abdominal wound infection, and right-sided pneumonia. She is still living. She has never had any trouble with her stomach but has since had a gallbladder operation.

I approve Dr. Wangensteen's position in these late perforations of the duodenum. I have seen patients, operated on late, with very small perforations with localized peritonitis, who died, who might have recovered had they not been operated on.

DR. A. R. COLVIN (Saint Paul): The recital of Dr. Wangensteen's cases shows again the great variability of the reaction of individuals and individual tissues under apparently similar conditions. I was glad that Dr. Wangensteen always advised suturing a perforation into the free peritoneal cavity. Just whether the perforation occurs into the free peritoneal cavity, we cannot say. However, this is the rule, so that, other conditions being favorable, we should always operate in cases seen early.

I recall a case in which I sewed up some fifteen or twenty wounds in the small intestine due to bird-shot. When I got through I was rather impressed that probably it was unnecessary to sew up any of them; there

was no leakage and they would perhaps have closed themselves after the fashion of valves. I operated on a young boy one time who was shot through the stomach; in the x-ray the bullet was shown back against his spine. At operation I found only the anterior opening in the stomach and was unable to find the posterior opening. That boy got well. The opening in the posterior wall of the stomach took care of itself.

One of my first experiences in perforating ulcer was in a young man who presented the picture of general peritonitis, almost pulseless, with blue lips and fingertips, and seemingly in extremis. His symptoms began thirty-six hours before I saw him, and I concluded it would be useless to do anything. His poor old mother stood by and looked so appealingly at me that I told her if she wanted to take a 1 to 1,000 chance I was willing to take it also. We sent the boy to Ancker Hospital. Not being able to say whether his peritonitis was due to a perforated ulcer or a ruptured appendix, I made a right gridiron incision, and air and fluid came out with a hissing sound. An upper abdominal incision was then made and a perforation of the duodenum sutured; another incision was then made in the left lower abdomen and drainage instituted in all three openings, and, although a lot of fluid was obtained through all three openings, there must have been still a lot left; and there was no postoperative drainage. The boy got well and I operated on him about fifteen years later, doing a gastroenterostomy for an obstructing ulcer.

One of the points brought out by Dr. Wangensteen is that the peritoneal cavity takes care of some of these perforated ulcers, or, rather, that it walls off and isolates the extravasated material; and Dr. Schwyzer's case illustrates the amount of stomach contents that the peritoneal cavity will take care of. There was practically no postoperative drainage in the case reported above and the peritoneal cavity still contained a lot of extravasated material and yet the boy got well. Dr. Wangensteen's cases prove that the perforation becomes sealed up at times and that a peritoneal abscess may result and be opened later. If one knew that a localizing process would occur, it would be very rational to let it localize and open later, but they are not all quite so fortunate as Dr. Wangensteen's cases were. I operated on a man for perforated ulcer and sutured it. He did not do so well, and while I was speculating as to the nature of the postoperative complication, a subdiaphragmatic abscess ruptured into a bronchus and he recovered. It would have been much better if I could have located the abscess and opened it. In another exactly similar condition I "beat Nature to it" and opened the subdiaphragmatic abscess, and that patient also got well. While Dr. Wangensteen's cases are interesting and very instructive, I feel as he does, that when we see a perforation early it should be operated upon at once.

That a perforating ulcer may not cause so very much trouble is illustrated by a case at Ancker Hospital. While I was attending a conference at the hospital, an intern came in saying that a man was in a bad condition from a perforated ulcer. When seen by several of the staff about fifteen minutes later, we were all impressed with the fact that the man's condition was not so severe as the intern had indicated. X-ray showed quite a lot of air beneath the diaphragm. I discussed operation with him but he refused, and in a short time he left the hospital perfectly well. Another similar case presenting about the same picture was not operated; he later developed a subdiaphragmatic abscess and was operated with success.

I feel that these cases will have to be dealt with individually and according to the experience and judgment of the individual surgeon.

Dr. R. T. LaVake (Minneapolis): Dr. Wangensteen emphasizes, in his paper, the characteristic rigidity of the abdomen with its bearing on diagnosis. I would like to report a case that shattered my feeling of confidence in my ability to diagnose a perforation under all conditions.

This woman in the sixth month of her pregnancy developed a pre-eclamptic toxemia and for the last three weeks of the sixth month was in the hospital under intensive treatment. During this time she complained of desultory epigastric pain that we considered a manifestation of the toxemia, as she had never had the pain before in her life and had never given any evidence of previous gastrointestinal disturbance. Due to the precariousness of her toxic condition and her earnest desire to get a live child, we did not subject her to gastrointestinal studies. At precisely the beginning of the seventh month of pregnancy the membranes ruptured spontaneously and she delivered, normally, a live premature baby. During gas anesthesia, toward the end of delivery, the anesthetist said she had stopped breathing. Under artificial respiration she snapped out of this condition and, after delivery, was put back to bed in apparently a normal condition. This was about 4 p. m. The next morning she complained of a bit of abdominal discomfort, which she said had bothered her through the night, although the special nurse had noticed nothing unusual. Her abdomen was moderately ballooned but there was no rigidity and we thought it was a gas retention problem, a condition not very unusual after labor. About 2 p. m. that day she had acute abdominal pain followed by marked distention. No rigidity could be made out and the condition was attacked with enemas. She went from bad to worse and died just thirty-six hours from the time of her delivery. The diagnosis was mesenteric thrombosis.

At autopsy it was found she had a perforation in the duodenum. The lesser sac of the peritoneal cavity had a shaggy lining looking almost like an abscess cavity. The greater sac was inflamed and full of intestinal contents. I believe this rupture occurred under the anesthetic during her delivery.

I have never reported this case because it is so unusual that I did not think it would help anyone. The absolute lack of the type of rigidity that Dr. Wangensteen so correctly emphasizes, threw me off the track and the possibility of perforation was not even suspected. This case suggests that epigastric pain in toxemia of pregnancy warrants extensive gastrointestinal

studies and should not be positively ascribed to the toxemic condition.

Dr. Wangensteen (in closing): What Dr. Schwyzer had to say of the encapsulated nodules in the peritoneal cavity interested me very much. In the patient operated upon remotely in this series, there was a similar finding. We were uncertain whether these nodules were the vestiges of an old healed peritoneal tuberculosis or the residual evidence of the escaped duodenal content, until the microscope showed the presence of the foreign body reaction described by Dr. Schwyzer.

I was happy to find that my experience coincides with that of Dr. Schwyzer as it relates to the factor of shock in perforation. In the perforations of gastric and duodenal ulcers which have occurred in the hospital or in other patients coming early for closure of a perforation, I have never seen so-called surgical shock with quickening of the pulse rate and depression of the arterial pressure. Invariably, such patients are found to be severely prostrated because of the agonizing distress, but shock in the true sense, in my experience at any rate, does not occur. It is interesting that despite a studied effort, extending back over eight or nine years, to teach our junior and senior medical students that the complication of shock does not attend perforation, more frequently than not in their examinations they indicate that shock does occur. For a period of about three years during which we have given oral examinations to the seniors, I have suggested to those giving such a reply that they write me when they see surgical shock accompanying perforation of an ulcer. To date, no description of such an occurrence has been received.

These answers of the students do not originate de novo. The explanation is to be found in the antiquated information to be found in many of our best surgical textbooks. When the authors of texts will write of what they know and have themselves observed and cease to repeat the ancient errors copied from older texts, this and other similar errors will no longer be perpetuated.

The problem of what is best to do with some of these late perforations can undoubtedly be better settled by trial of different methods than by discussion. In the late cases of more than 24 hours' duration, the results on the whole are so bad by any form of management that a selection of cases for varied types of treatment would appear to be fully justified. The uniform experience in the closure of late perforations into the free peritoneal cavity has been that the risk is formidable. When the majority of writers relate that the mortality for perforations of more than 25 hours in their experience has been between 50 and 70 per cent, and a few other writers are able to report small series of almost uniform recovery, it is immediately apparent that they are dealing with different types of cases. The latter are undoubtedly the so-called "formes frustes" of Vaughn and Singer.

There can be no debate about the early case. Closure of the perforation should be done immediately. Those patients presenting the clinical picture of perforation in which no gas can be demonstrated below the diaphragm on the roentgenogram exposed with the patient in the erect posture, in my experience, can be safely treated without operation. The "formes frustes" patient coming after twenty-four hours, relating a story of perforation but exhibiting minimal findings, and revealing only minimal amounts of gas below the diaphragm, may also be treated safely with conservatism. The patients who come late and exhibit diffuse findings but manifest some signs of localization as indicated by (1) the presence of a relatively small amount of gas below the diaphragm, (2) the presence of a dense shadow in the upper right abdomen—it is my impression that the interests of these patients is better served by conservative treatment, of which suction applied to an inlying duodenal tube is the most important item. Cases who come late, in which there is no evidence of localization and in which escape is probably still occurring from the perforation as manifested by a large amount of gas under the diaphragm—such patients, if their general condition warrants, must be subjected to operation despite the risk. When the physical status of such patients is poor, no good can come from operating upon them.

Dealing with perforations in the gastrointestinal canal is essentially a problem in bacteriology. The relatively anaërobic character of perforations due to ulcer in the stomach or duodenum makes this potential tragedy considerably less dangerous than perforations of a similar size lower in the intestinal canal. It is to the development of bacteriological aids that we must look for help in our anxiety to manage more successfully late perforations due to ulcer.

MEGAKARYOCYTOMA

Dr. Martin Nordland (Minneapolis) reported a case of Megakaryocytoma in a woman fifty-six years of age, with operation and recovery.

The meeting adjourned.

R. T. La Vake, M.D.
Secretary.

TRANSACTIONS *of the* MINNEAPOLIS SURGICAL SOCIETY

ANNUAL SYMPOSIUM ON CANCER

THURSDAY, APRIL 4, 1935

The President, DR. MARTIN NORDLAND, in the Chair

(Continued from June, 1935, issue)

ORGANIZATION OF HOSPITAL SERVICE FOR DIAGNOSIS AND TREATMENT OF MALIGNANCY

F. A. Olson, M.D.

At the Cancer Symposium held by the Society on April 5, last year, an attempt was made to correlate and evaluate all available information regarding the occurrence of cancer in private practice in Minneapolis and the means at hand for its treatment.[13] It was brought out that in Minneapolis alone, out of 5,176 deaths, there were 729 deaths reported from cancer in 1932, and now we know that there were 822 in 1933—745 in 1934 (two a day). Further, it was conservatively estimated that approximately 1,000 cases of malignancy were being treated annually in the hospitals of the city, 70 per cent of which were cared for by private physicians. It was further shown, and this is from Dr. Rector's report, that, taking the State as a whole, there were 3,199 cancer deaths in a typically representative year, or one every two and three-quarters hours. We find that, in a thoroughly normal year, 3,505 patients with malignancy were seen at the Mayo Clinic—638 of these coming from the state of Minnesota. Hence, it is evident that the State and our immediate locality is no exception to the rule that cancer is rapidly becoming one of the most serious problems, if not the most serious problem, the medical profession has to deal with today.

Those of you who attended the symposium, "Cancer is Curable," held by the American College, last October, in Boston, may have heard Dr. Martin[8] report on 150,000 cancer deaths in the United States and Canada for 1933. At the same time he reported from the College records of 1932, 1933 and 1934—24,440 cancer survivals of cures of five years or more.

The control of the cancer situation should remain absolutely within organized medicine. This fact presents itself as a great challenge to the profession and especially those interested on its surgical side. To allow the problem to drift, presents just one more entering wedge for governmental usurpation and control.

Rector[12] says: "Cancer is a problem for the medical profession and the hospitals, and the interest of the intelligent public should be restricted to strengthening the resources of these two groups. How long the lay activities can be held to this purpose depends on the wisdom and alacrity with which the profession and the hospitals meet this situation."

Pack,[11] in his discussion of the organization of a tumor clinic in a general hospital, states: "Cancer is a major health problem which must be met by the boards of managers and the medical staffs of the large general hospitals. No such hospital today can be considered fully efficient unless a well-organized cancer service exists within its doors."

Organization

Two national organizations have sensed the battle for a long time. The American Society for the Control of Cancer was organized and has been active since 1913. As you know, this body is simply fact finding and educational in scope. The second is the American College of Surgeons whose "Committee on the Treatment of Malignant Diseases" was formed in 1922. (Two other committees of the College have functioned almost as many years, the Committee on Archives of Malignant Diseases and the Committee on Bone Sarcoma.) The personnel of the original Committee on Treatment of Malignant Diseases is sufficiently noteworthy to bring to your attention. The chairman was R. B. Greenough of Boston, who had served continuously until his election to the presidency, last October; A. C. Broders of Rochester, Burman of Baltimore, Crile of Cleveland, Crowell of the American College, Duane of Boston, Ernst of St. Louis, Finney of Baltimore, Lee of New York, Lynch of San Francisco, Miller of Baltimore, Pancoast of Philadelphia, Wells of Chicago, and F. C. Wood of New York. To date, this committee has presented the most constructive national program of attack upon the problem. Committee chairman, R. B. Greenough,[7] said in October, 1930: "The plan for organization of Cancer Services and Cancer Clinics in General Hospitals throughout the country, which is outlined by the Committee on the Treatment of Malignant Diseases, marks a definite step forward in providing more adequate service for cancer patients."

A few of this committee's recommendations[2] I would like, briefly, to present to you, with special reference to our local conditions and problems. These recommendations have been published from time to time, the first appearance being in *Surgery, Gynecology and Obstetrics,* for October, 1930, or about four and a half years ago. They pointed out that the resources available for diagnosis and treatment of cancer cases at that time were:

I. Cancer Institutes
II. Cancer Research Hospitals
III. Cancer Hospitals
IV. Cancer Clinics in General Hospitals
A—Complete Cancer Clinics
B—Diagnostic Cancer Clinics.

It is this last type of tumor clinic that seems best suited as a base for a starting point and which, in possibly a modified form, could easily be made a valuable beginning of better things in each one of our larger private hospitals.

I. Of the *cancer institutes* equipped with a hospital and laboratories for research there will never be more than a few on account of the great cost. Examples are: Memorial Hospital, New York; New York State Institute for the Study of Malignant Diseases at Buffalo; The Cancer Committee of Harvard University, with its hospitals and laboratories, Boston; Barnard Free Skin and Cancer Hospital, St. Louis; and the Radium Institute in Montreal.

II. *Cancer research laboratories* are, also, very expensive and their numbers necessarily are limited. Examples: The Cancer Research Laboratory of Columbia University; The Rockefeller Institute, New York; and Sprague Memorial Institute, Chicago. They are dependent on large endowments and devote their efforts solely to research.

III. *Cancer hospitals:* These are state supported or heavily endowed hospitals, such as the one seen in Massachusetts and the Cancer Institute on our campus. Several of these are coming into existence as departments of already established hospitals.

IV. *Cancer clinics:*

A—A Complete Cancer Clinic.

According to the recommendations, a complete cancer clinic requires:

1. Organization of a staff of specialists.
2. Adequate diagnostic and therapeutic facilities.
3. Adequate record system.
4. Clerical assistants.
5. Social service workers.

To summarize, such a complete cancer clinic in a hospital should have:

Personnel

a—Chief of Staff, preferably a member of the the Surgical Staff.

b—Representatives from:

1. General Surgery, including Gynecology.
2. X-ray therapy experts.
3. Radium therapy experts.
4. Pathologist skilled in tumor diagnosis.
5. Internist.
6. Representatives of all specialties as consultants.
7. Record clerk, follow-up system and social service workers.

Material Resources:

a—Instruments and laboratories for all usual diagnostic methods.

b—Pathological laboratory service.

c—Operating services and other ordinary hospital facilities.

d—Adequate service of x-ray and radium.

Meetings:

a—Daily, weekly, or semi-weekly sessions of the clinical staff and a monthly joint meeting with the entire staff.

B—Diagnostic Cancer Clinics:

Groups under this heading could be formed in any reasonably large hospital or group of hospitals where complete service, such as mentioned above, is not yet available. Weekly meetings should be held at first, possibly in conjunction with or in nature of an extra-special clinico-pathological conference. Practitioners could be encouraged to bring patients to such a conference where group judgment might be obtained and where the practitioner would later be free to continue the care of the patient as he saw fit.

The Committee of the American College recommends that the personnel of such a diagnostic clinic be as follows:

1. A director, preferably a surgeon with some facilities of leadership, together with good technical training, knowledge of the subject and enthusiasm.
2. One or more surgeons.
3. Pathologist.
4. Roentgenologist.
5. Internist.
6. Gynecologist.
7. Dermatologist.
8. Urologist.
9. Gastro-enterologist.

A suitable staff of consultants should be chosen, together with such clerical assistants as are usually obtainable in the average hospital. The house staff could be used to advantage in many ways. It is easy to see how even a flexible and rather loosely knit organization, such as this, could be *incorporated* and hence be in position to receive bequests with the purpose of later establishing a complete cancer or tumor clinic such as outlined in the recommendations of the College.

It is certain that once a working group even of this simple nature was organized in the average medium-sized or larger hospital, it would not be abandoned but would continue to grow. As W. W. Keen, in one of his favorite expressions, would say—"Now, that I have seen it I cannot be without it."

The clinico-pathological conference so ably conducted by Dr. C. R. Drake, at the Swedish Hospital, is a good example of a foundation upon which such a diagnostic tumor clinic could be built up with very little alteration and enlargement. Soon it could easily meet every requirement laid down by the College, as a fully approved cancer clinic.

Advantages

The establishment of a diagnostic tumor clinic such as set forth would seem like a logical first step. Enlargement of the scope and additions could be made from time to time as a matter of natural growth. Some might maintain that the set-up, as outlined by the College, is too advanced for us at this time. Almost any hospital has the personnel and equipment for such a service. A little more concentrated attention by the management and inauguration of a bit more special service by the Staff group, as outlined, would greatly augment the efficiency of the hospital in the campaign against carcinoma. That the professional prestige of the hospital would be enhanced is only too evident.

The effect of the American College program has been dramatic. In 1920, there were fourteen cancer clinics in the United States. The February, 1932, report showed:

Approved—American College of Surgeons, 100.
Recommended for approval—58.
In process of organization—185.

By February, 1935:
Approved by the American College of Surgeons—181.
Not ready to report—58.
Signified their contemplation of formation—80.

Dr. R. T. Pack[11] says that in his opinion there can never be too many diagnostic clinics in any city.

While this movement towards the establishment of the diagnostic tumor clinics has spread over many centers, as yet it has not influenced the managements or staffs of any of the private hospitals in Minneapolis forcibly enough to bring action. The hospitals[6] conducting approved cancer clinics in our section of the country are: University Hospital, Minneapolis; Mayo Clinic, Rochester; Northern Pacific Benefit Association Hospital (provisional), St. Paul.

Montana has one, the Murray Hospital, at Buttte. Iowa, North Dakota and South Dakota have none.

The inference from this report would indicate that there is plenty of opportunity for further development in this district.

I would like, briefly, to mention a few more of the many advantages that could accrue from a well organized tumor clinic:

1. *Better service:*

The patient would receive a more comprehensive study and more efficient treatment.

2. *Educational value:*

a. *To the Public:*

It has been the experience, where tumor clinics have been established, that patients begin to come in earlier and earlier for examination, in other words, at a time when the diagnosis is more difficult and treatment easier, rather than when the diagnosis is easy and the treatment most difficult. The prevailing feeling of pessimism in the community has been found to diminish in proportion to the activity of the diagnostic group.

b. *To the Hospital:*

Frequent reports could be made to the Staff as a whole.

Better records and follow-up would be obtained.

Incidentally, the College has made a most comprehensive set of record blanks for this purpose: some eighteen different forms for the various types and locations of malignancies.

c. *To the Profession:*

The diagnostic skill, both clinical and pathological, of any group working under such an arrangement would rapidly be increased by the greater experience in actual observation and study of all the tumors and pathological material passing through the hospital. Bloodgood,[1] in an article appearing in the *Canadian Medical Association Journal* for June, 1933, touches on this point. He says, "The profession has never been taught the essential facts in the diagnosis and treatment of carcinoma, *in the earliest*, the *most innocent* and the *most difficult* stage to diagnose."

Further, such a diagnostic tumor clinic could instill a working knowledge of the effects of radiation therapy in the immediate group and the professional staff as a whole that would tend to dispel the present pessimism and lethargy as regards cancer prognosis which is everywhere quite evident among medical men. It is axiomatic that the interest of anyone is stimulated and maintained in any field in direct proportion to his *knowledge, skill,* and *training* in the subject.

X-ray and radium therapy is the most highly specialized form of treatment known to medical science today. In the past it has been and is now shrouded in more than a small amount of mystery. The profession has often not availed themselves of its benefits as readily, persistently, and early enough to produce the maximum benefit to their patients.

More and better palliative care, both as regard irradiation and other special treatment would be made available and carried out for the inoperable and the otherwise hopeless cases. I have reference to the analgesic effect of x-ray and radium, chemo-therapy with heavy metals and the use of dilaudid, etc.

Past experience in irradiation has always shown that, as technic and equipment are improved, end-results improve in a direct ratio. It is to be hoped that with the installation (one now being actually under way) of the new 40,000-volt constant potential, x-ray machine which gives a beam closely approaching the Gamma ray of radium, this city will see less and less of the hopeless feeling in regard to cancer in both the profession and laity. It has been stimulating to me, and I am sure it will be to many of you, to realize that soon a weapon of such power, in the war on cancer, will be available to the private patient of the ordinary practitioner in Minneapolis. A machine of 400,000-volt constant potential develops the same length of beam as one of 650,000 volts with pulsating energy. In this connection, I quote a statement by Mudd, Emery, Meland, and Costolow:[10] "At the end of three years of experience at the California Institute of Technology and the treatment of 285 patients, we are of the opinion that heavily filtered radiation at 600,000 volts or higher

seems to offer better possibilities in the treatment of certain types of deep-seated cancer than irradiation at substantially lower voltages. The results compare favorably with those produced by a 4 gm. radium pack."

We, of the Surgical Society, would like to believe that the installation of such expensive x-ray equipment has been stimulated materially by the agitation we have created by our several Annual Cancer Symposia. Again, we would modestly like to believe that the "Tumor Registry" instituted last year in the city of Saint Paul may have derived some stimulus from this same agitation.

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CARCINOMA OF THE STOMACH

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A discussion of carcinoma of the stomach seems to be particularly timely in view of the perfectly hopeless outlook which has usually been presented to patients suffering from this malady. It might seem that at last we may assume a more hopeful and optimistic attitude toward palliation or even possibly toward a cure. Better results can only be accomplished through education of the patient to consult his physician at the very onset of symptoms and also to educate us as physicians to exercise every means at our command to diagnose cancer earlier.

Dean Lewis states that only 20 per cent of carcinomata involving the stomach which report at Johns Hopkins Hospital are resectable; and still, Dr. Warwick from Minneapolis showed that 23 per cent of necropsies on patients dying from cancer of the stomach had no metastases. Gatewood, in an analytical study, showed that his patients waited an average of 5.3 months after the onset of symptoms before seeing a doctor. After these patients consulted their physician another delay of 8.3 months occurred before the patients were submitted to operation. The second delay rested squarely upon the shoulders of the physician and was too often due to his hopeless attitude. It is impossible for me to paint a glowing picture of the end-results but I hope to present to you a brighter and more optimistic side to be obtained by surgery in suitable cases.

Carcinoma of the stomach involves the male at least twice as often as the female. Family history plays a part in only 16 per cent of cases. While the average age incidence is about 56 years, 25 per cent of the patients with this disease are under 50, Osler and McCrae reporting six patients under ten years of age. One of our own cases with inoperable carcinoma was only thirty-one and twenty patients were under forty-five years of age.

While various reports throughout the large clinics show that only 50 per cent of stomach cancers are operable, a recent report by Balfour gives more encouraging figures. Fifty-eight per cent of all cases diagnosed carcinoma of the stomach were advised exploration and in 42 per cent of the explored cases, removal of the growth was possible. There is no question but what these are the most promising statistics and because of the fact that these patients were explored at an earlier date, Balfour is able to report 273 patients in whom resection of the stomach was performed who lived five years or more. Of these, 128 have liver more than ten years. This must be taken as a hopeful sign if one considers the report of Friedenwold in 1914 when only 3.3 per cent of 1,000 cases were resectable. Fifty per cent of the cases reported by Gatewood were pronounced inoperable and the majority were victims of procrastination. Of the operated cases, 40 per cent of the patients who recovered from resection lived more than five years, two of his patients surviving sixteen and seventeen years each. Bloodgood, in 1915, stated that only 26 per cent of cases seen by them were operable. A review of the cases as they report for treatment shows that in general, 50 per cent of carcinoma cases are inoperable, 50 per cent subject to exploration and only 25 per cent are resectable. Finsterer, however, resects 65 per cent of his cases of gastric cancer. It is encouraging to note that 31 per cent of Finsterer's patients with simple resection and 30 per cent of patients surviving operation in which resection of the liver, pancreas or colon was necessary, lived from five to eighteen years without recurrence. Dr. Arnold Schwyzer reports one patient living twenty-four years after removal of cancer of the stomach without recurrence. Langdon Parsons states that without operation the average length of life in their series was but six months while in the cases resected, 38 per cent of those who survived had a chance to live more than five years and 56 per cent more than three years. Compare these statements with the fact that without resection, all die and that the average length of life is from 5 to 15 months after the diagnosis is once established.

Pathology.—Bloodgood states that carcinoma of the stomach starts as a local growth in the mucosa. At first of very small size, it develops until it involves the wall of the stomach which becomes thickened and it may occur at any point between the pylorus and the esophagus. In the early stages there is no change on the peritoneal surface. Under the microscope there are epithelial cells of distinct morphology, recognizable as cancer cells, the arrangement of these cells varying according to the picture of the various types of carcinoma. In the Mayo Clinic it is held that there is a

type of cancer in which the primary stage is chronic ulcer and in which there is a definite displacement of the cells of chronic inflammation by typical cancer cells. The lesion changes in type from the flat edged ulcer with crater to one with elevated edge and uneven border or niche which, with a crater wider than 25 centimeters, is usually malignant. In many of these ulcers it is impossible to tell by gross appearance whether they are or are not malignant, and the final diagnosis rests upon the microscopic examination. The chronic ulcer under the microscope shows the inflammation with the granulation base while the malignant ulcer shows the invading carcinomatous cells involving the edge of the ulcer or displacing the granulations in the base.

Much argument has arisen as to the percentage of cancers which develop on ulcer, MacCarthy contending that as high as 70 per cent of their cancer cases develop upon ulcer. Moynihan believes that two-thirds of their cancer cases develop upon an ulcer base but Ewing places the figure at only 5 per cent. Bloodgood likewise believes that the percentage is small. It would seem that, in any event, the theory of chronic irritation as an etiological factor may well play a part in the pathological change which takes place in the degeneration of a chronic ulcer into a carcinoma. The change from benign tumors to cancer of the stomach is probably a good deal more rare than formerly had been supposed.

Symptomatology—One must constantly bear in mind that early cancer produces but few symptoms. A patient, especially a male, in the cancer age who complains that he is not perfectly well, is pepless, tires easily, cannot concentrate upon his work, sleeps poorly, and feels a general malaise, has lost some weight and is slightly anemic should be carefully regarded for possible beginning cancer. Moynihan speaks of it as the earliest departure from health of which he is aware. Maes says the use of the thermometer and the sputum bottle in the young should be supplemented by gastrointestinal x-ray examination in older individuals. Dyspepsia may not appear until a late date in primary cancer while it may predominate in the cancer developing on ulcer. That group of chronic dyspeptics who often have a protracted ulcer history who present a recent distinct change in complaints, a sudden exacerbation of symptoms, an absence of interval relief and a lack of response to any form of medical management, must be studied carefully for cancer developing on ulcer. Loss of appetite, epigastric pain, vomiting, loss of weight, tarry stools, marked anemia and a palpable abdominal mass are listed in medical text books as the symptoms of stomach cancer. They are diagnostic signs of advanced disease and if they are waited for we can never hope to improve the end-results of surgery.

Anemia is apt to be severe in any malignancy but is never a constant finding. Progressive loss of weight usually indicates advanced disease. A tinge of jaundice is suggestive. Chemical blood in the gastric content and stool is an important finding but may be even more frequent in benign gastric lesions. Hydrochloric acid may be absent but Hartman reports free hydrochloric acid in 50 per cent of cases studied at the Mayo Clinic. In fact, perfectly normal chemical findings are not incompatible with gastric cancer. Blood studies, gastric analyses and other clinical and laboratory data should always be available but cannot be considered pathognomonic until late in the disease.

X-ray examination of the stomach at the present time constitutes our greatest diagnostic asset but must be used in connection with history and other examination data. White and Leonard state that in no case that they reported as a normal stomach was cancer proved to exist, and Carman found that 95 per cent of gastric cancers gave roentgenologic evidence of their presence. In the hands of a thoroughly competent radiologist, early filling defects, lack of peristalsis or the appearance of a chronic ulcer may suggest early malignancy or gross obstruction, and gross defects may positively detect it. On the other hand, in those occasional doubtful cases, an inventory of all available data, clinical history, etc., must be considered by clinician and radiologist together before a definite diagnosis can be determined and a safe plan of treatment outlined. Re-ray after a short interval may be most important.

Treatment—Given a typical case with generally positive findings of carcinoma of the stomach one must determine whether or not exploratory operation is indicated. McVicar called attention to the most common sites of metastases as follows: rectal shelf, liver, supraclavicular lymph nodes, peritoneum (ascites), umbilicus and chest. No patient with carcinoma of the stomach should escape an examination of the rectum. Implants to the pelvis give rise to that firm, cartilaginous feel or a sense of firm resistance to the peritoneum, and occasionally the presence of hard nodules can be made out. The Krukenberg tumor, the result of implants in the pouch of Douglas, may be present, gross involvement of the liver may be detected on examination or by x-ray after the use of thorotrast. Liver involvement usually indicates inoperability although its involvement may not preclude palliative surgery. The presence of hard, supraclavicular nodes in the presence of a positive diagnosis of carcinoma means metastatic involvement. If in doubt one of these nodes should be removed for biopsy. Involvement of these nodes is due to spread through the lymphatics and, Balfour states, contraindicates any surgery as the span of life in such a patient is very short. Lymphatic involvement may be demonstrable in the region of the navel and is of grave import.

In the absence of gross evidence of metastasis, the surgeon must be governed somewhat in his course of treatment by the duration of symptoms, the size and amount of fixation of the tumor and the general physical state of the patient. Exploration should be performed whenever no absolute contraindication exists with the purpose of (1) cure and (2) palliation. Reported cases prove conclusively that clinically inoperable carcinoma may be benefited by resection of

the primary mass and that even in the presence of ascites, Krukenberg tumors and metastatic involvement of lymph nodes and liver, pain is relieved, cachexia disappears, general sense of well being returns and the patient may live in comfort for two to three years to die a painless death from liver metastasis. One patient of our own in whom we did a partial gastrectomy in the presence of liver and lymph gland involvement, had a complete relief of symptoms for more than one year and became so well that his insurance company refused to continue his disability. Occasionally, instances occur when radical surgery is performed, and enlarged, inaccessible lymph glands are not removed but the patient remains well for ten years or more. This would indicate that the remaining glands were not malignant or that the disease ceased to progress after the operation. Stimulated by prospects of real palliation, partial gastrectomy should be performed whenever possible in preference to any other operation. Finsterer says, "Without resection every patient will die, and die in pain and misery. Therefore, I must resect whenever possible." In the presence of early or resectable cancer, one should always aim toward permanent cure. Balfour reports that when cancer was confined to the stomach, 53 per cent of patients lived three years but when adjacent lymph glands were involved, only 20 per cent lived three years. It is inevitable that the degree of malignancy of the lesion will determine to a large extent the end-results. Gray's figures indicate that of their patients who lived ten years, 61 per cent were graded Group 1 or 2 and 39 per cent were graded Group 3 and 4. In those cases of Grade 1, the prognosis was twice as favorable as those of Group 4.

Bloodgood says that the prevention of chronic ulcer is a prevention of carcinoma. Lahey teaches that within a period of three weeks of intensive medical treatment all symptoms of gastric ulcer must be completely relieved, that x-ray study must show definite improvement and finally healing, and that blood must disappear from stool and gastric contents or surgery is indicated. Moynihan warns that even gastric carcinoma may show a degree of clinical silence with rest and diet. When in doubt, exploratory operation must be employed and the lesion excised or partial gastrectomy performed. The diagnosis as to whether a lesion is benign and can be satisfactorily treated by excision or gastroenterostomy, or whether the lesion is malignant and will require gastric resection is one that must be made at the time of exploration and upon its accuracy must hang the life of the patient. According to Alvarez, an ulcer the size of a dime has a 1 to 15 chance that it is benign, the size of a quarter, 1 to 10. If the size of a fifty cent piece, 2 to 1 chance it is not benign, and if the size of a dollar, carcinoma is almost positive. The large ulcer with deep penetrating notch is usually benign, while the more shallow ulcer with elevated edge and a niche, 2.5 centimeters, is prone to be malignant. The microscope may be required to make the diagnosis certain. Recently in a case of obstructing ulcer of the pylorus we performed gastric resection for what appeared to be a benign ulcer both clinically, by x-ray and in gross specimen, but which the laboratory reported to be definitely malignant. Because of the possibility of malignancy being present, partial gastrectomy fortunately was done and not a gastroenterostomy. At almost the same time excision of a larger penetrating ulcer on the lesser curvature proved to be non-malignant. It is in this type of surgery where the lesion is so early that radical surgery may expect to produce its cures.

Operative mortality ranges from 5 to 51 per cent and usually simple exploration and gastroenterostomy carry the highest mortality as they are done on the poorest surgical risks. Gastroenterostomy is a very poor palliative operation because the poor musculature of a carcinomatous stomach means a poorly functioning stoma, the life of the patient is prolonged only a short time and pain often persists because the ulcerating tumor mass still remains. Exclusion, as recommended by Balfour, divides the stomach above an irremovable tumor, turns in the distal end and anastamoses the proximal end after Polya. This operation is scarcely more hazardous but diverts the current from the diseased portion and thus relieves pain and promotes an improved general health. Simple gastric resection is performed for carcinoma of the stomach with a mortality of approximately 10 per cent. It should always be the method of choice in early tumors as it is the only chance for permanent cure. On the other hand, it should always replace gastroenterostomy and exclusion even in the presence of irremovable metastasis when the primary mass is removable because as stated, removal of the tumor stops pain and cachexia and many patients survive 2 to 5 years, to die of painless liver metastasis.

One of our patients on whom we removed the entire stomach from pylorus to esophagus was so relieved. He regained his health completely so that he pursued his hobby of hunting ducks, deer and bear, and told me that he had enjoyed more real pleasures than he had ever had before in his life. He stated that that one year of comfortable activity and the relief from intolerable pre-operative pain well repaid him for the discomfort of a surgical operation. Several instances are reported in which resection performed as a palliative procedure had produced entirely unexpected five year cures. The very radical, complicated resection of Finsterer in which the liver, pancreas or colon are also resected carries a mortality of 41 per cent but is justified by the fact that 30 per cent of survivals live five to eighteen years.

Safety of operation is enhanced by careful preoperative preparation consisting of a sterile diet for at least three days, repeated gastric lavage and replacement of fluids and blood. Many postoperative deaths are due to peritonitis in carcinoma patients, the result of an infected stomach content. In ulcer, the stomach content is virtually sterilized by the hydrochloric acid which has been accepted as an indication for its administration and irrigation with .25 per cent solution for several days preoperatively.

The writer has observed more than 60 cases of cancer of the stomach in the past twelve years. The

youngest was thirty-one and the oldest, seventy-eight. In a series of 50 cases, seventeen, or 36 per cent, were considered inoperable, seven were explored only; there were seven gastroenterostomies and eighteen gastric resections. Among eighteen gastric resections there were three deaths or approximately 16 per cent. There were two total gastrectomies with one death. One resection with a preoperative diagnosis of carcinoma proved to be syphilis and the patient is well. In only two of the patients who had resection could the lesion be called early. It has been quite impossible to obtain a follow up record but some of these patients are known to be alive and well although they are all recent or under three years.

Conclusions

1. Improved results from gastric surgery performed for carcinoma of the stomach must depend upon earlier diagnosis and earlier operation. This can only be secured by education of the patient to consult his physician at the first onset of symptoms, and the early diagnosis of carcinoma by the attending physician.
2. The x-ray at the present time is our greatest aid in diagnosis.
3. Chronic gastric ulcer which does not respond to medical management demands surgery.
4. The end-results of surgery in gastric cancer are not brilliant but it is infinitely better for a patient with gastric resection to live a few years in comfort than to go on to a rapid painful death.
5. Surgery should always be directed toward a permanent cure but in the absence of this possibility, palliative surgery produces many very gratifying results. Gastrectomy should at all times be the choice in preference to gastro-enterostomy or exclusion.

ELECTROCOAGULATION OF CARCINOMA OF THE RECTUM AND SIGMOID

James A. Johnson, M.D., F.A.C.S.

Carcinoma of the rectum and sigmoid comprises about 4 per cent of all carcinomas of the body, and 80 per cent of all carcinomas of the large bowel are located in this area. Its very location makes it a particularly hazardous disease. Although a great deal has been done during the past decade to improve the mortality and to bring about better results in the treatment of this condition, there is still much to be desired.

As in other parts of the body, the great majority of these cases occur during the cancer age, and most frequently during the fifth and sixth decades. It is not at all unusual, however, to have the condition develop in the thirties, and I have seen a fatal case at the age of nineteen.

The etiology of carcinoma of the colon is no more clearly understood than is that of carcinoma of other parts of the body. However, since such a large percentage of carcinomas of the colon occur in the rectum and lower sigmoid, it is quite probable that constant irritation is a factor in its development. This is also a frequent location of adenomas, polyps and diverticulitis, and it is a proven fact that many of these undergo malignant changes. It is quite probable, therefore, that carcinoma often develops as a result of preexisting lesions, and this in a measure may account for its frequency in this locality.

With the exception of epitheliomata (squamous cell carcinoma) which occur only when the growth arises from the perianal skin, all carcinomata of the rectum and sigmoid are adenocarcinomata and vary in their appearance only because of their cellular structure and method of growth. Clinically, there are four types of carcinomas in this locality:

1. The raised or polypoid growth which tends to block the lumen and often gives rise to early bleeding. As a rule they produce early symptoms and are less malignant.
2. The ulcerating, crater-like growth with a nodular margin. These penetrate deep into the surrounding structures, often are late in producing symptoms, and relatively early in invading the lymphatics.
3. The annular constricting growth which contains a large amount of fibrous tissue, and causes early constriction of the bowel. Occasionally acute intestinal obstruction is the first serious symptom.
4. The soft gelatinous or colloid growth, either single or multiple. These are usually rapidly growing and highly malignant.

The symptoms vary with the location and type of growth. When located in the right half of the colon constipation, anemia and weight loss are usually the predominating symptoms, while those in the sigmoid and rectum often produce early diarrhea, together with frequent stools of mucus and blood. Any patient who has previously been regular, then becomes constipated, has diarrhea, loss of weight, and anemia, or passes mucus or blood in the stool should be carefully examined by proctoscopy and x-ray for the possibility of existing carcinoma.

Carcinoma in the rectum or sigmoid in any case is a serious condition, and carries with it grave consequences. The operative mortality is high in individuals in good health. When it occurs in the aged or in persons who have other serious lesions, we must of necessity consider the added risk. One can truthfully say that a carcinoma in this locality in an aged individual is not only a sad condition, but a very formidable lesion. It is often made all the more serious in many cases because of the presence of other lesions, such as coronary disease, myocardial degeneration and marked anemia with weight loss, which renders the patient absolutely unfit for any major operation. Often these old people are cared for by their relatives and do not, with a colostomy, become a welcome member of the household. To take the risk of a radical operation, together with subjecting them to a permanent colostomy, is certainly not very desirable.

It was when I was confronted with such a case on September 12, 1927, that I first employed electrocoagulation with destruction of the growth *in situ*. The satisfactory result obtained in this case has led me to its application in eight cases. I do not intend to have

this procedure replace the classical radical operations in cases that are considered good surgical risks. It is advocated here only for the cases of carcinoma of the rectum and lower sigmoid that would otherwise be considered inoperable or serious operative risks because of age or other lesions that would make radical operative procedure inadvisable. In these cases electrocoagulation offers the best solution. The mortality is very low, and the results compare favorably with radical operation.

If the growth is located in the extraperitoneal portion and has not penetrated into other vital structures, it can be completely destroyed. If it is in the intraperitoneal portion, especially if it is the infiltrating type almost completely involving the entire circumference of the bowel, there is always considerable doubt as to its complete eradication.

Electrocoagulation has been confined largely to the eradication of external growths. It has also been employed for some time to destroy malignancy in the urinary bladder. There are very few instances, however, where it has been utilized in rectal malignancy.

The cauterization is done with the coagulating current from a diathermy machine. Before beginning the operation, the cautery is always tested on a piece of raw steak. This is important in order to properly gauge its penetration. The operator should be thoroughly familiar with proctoscopy, and have the proper instruments at hand. I use a large operating proctoscope for lesions in the rectum. When the lesion is located high, in the intraperitoneal portion of the bowel, it is necessary to use a smaller scope, and the visualization is not as good as with the large scope.

The patient is placed on the operating table on the abdomen with the head lowered. Gas or local anesthesia may be used. When gas is used, it is always supplemented by infiltration of local anesthesia about the rectum. The proctoscope is introduced, and a careful examination is made in order to get a comprehensive estimate of the extent and location of the lesion. The growth is then systematically destroyed by coagulation *in situ*. The technic is often difficult and exacting. This is especially true when the lesion is located above the rectal shelf in the intraperitoneal portion. Great care must be exercised in this portion of the bowel to avoid penetrating its wall, with a resulting peritonitis. Smoke accumulates during the coagulation, but this can easily be removed with a suction apparatus. The operation must not progress too rapidly because of the intense heat that develops.

There is usually very little postoperative discomfort. The patient is kept on a liquid diet during the first two days, and after that a low residue diet, mostly semi-solid. On the third day he is given moderate doses of liquid petrolatum morning and night, and there is usually very little discomfort at stool. The confinement to bed depends on the location and severity of the condition. Most patients may get up and be about within a week.

I have not been confronted with any serious complications. There has been no postoperative bleeding. If this should occur it can best be controlled by the cautery.

Patients should be carefully examined two months after the operation for evidence of any remaining growth, and if any is present it is again carefully coagulated.

I have now operated upon eight patients using this method. Three had a second operation because of incomplete removal, and three had to be re-operated as a result of recurrence. This resulted in a total of fourteen operations. There has been no operative mortality.

The following are reports of cases treated by electrocoagulation:

Case 1.—Mrs. W., aged eighty-four, came for examination on September 12, 1927, complaining that during the past six months she had been passing blood and mucus in her stools and had lost about five pounds in weight. On proctoscopic examination a large ulcerating, infiltrating carcinoma about 8 cm. above the anal sphincter, involving approximately one-half the circumference of the bowel, was found. General examination showed a marked vascular sclerosis, blood pressure 220 systolic, 120 diastolic, frequent extrasystoles and a loud systolic murmur at the apex. She was obviously not in condition for radical operation. Her mental capacity was excellent.

On September 17, 1927, the entire growth was destroyed by electrocoagulation. Microscopic examination showed adenocarcinoma. She survived the operation without any difficulty. There was smooth healing of the bowel where the growth had been removed, and almost no narrowing of the lumen. On repeated examinations there has been no sign or symptom of recurrence. She is mentally alert and takes an active interest in life at the age of 92. It is now seven years and six months since her operation.

Case 2.—Miss G., aged seventy-nine, was first examined November 22, 1928. She complained that during the past ten months she had been passing blood and mucus in her stools. Previous history revealed that the right breast had been removed eleven years ago, probably for a non-malignant condition. Seven years ago she had fractured her right hip and was able to get about only by the aid of a cane. Proctoscopic examination revealed a large, infiltrating and ulcerating carcinoma on the right anterior wall of the rectum, involving the valve and extending down onto the internal hemorrhoidal area. On general examination there was marked arteriosclerosis and a deep-seated adenomatous goiter.

November 24, 1928, the entire growth was destroyed by electrocoagulation. Microscopic examination showed adenocarcinoma. She had an uneventful recovery and since she lived out of the city did not return for re-examination until February 9, 1929. At this time there was an extensive recurrence of the growth. This was completely destroyed by electrocoagulation. A recent examination revealed no sign or symptoms of recurrence and the stools are normal. She is now 85 years of age, and it is six years and four months since her original operation.

Case 3.—Mrs. S., aged sixty-two, reported for examination November 10, 1931, complaining of indefinite rectal distress with occasional diarrhea. Proctoscopic examination revealed a growth about one and one-half inches in diameter, of the raised type, located just behind the second valve on the right side. She had been a semi-invalid for several years because of an old pulmonary tuberculosis. A year previous to her examination she had fractured her left hip. She was not considered a good risk for radical operation.

On November 14, 1931, the growth was destroyed by electrocoagulation. Microscopic examination showed adenocarcinoma, Grade 2. She has had frequent examinations since that time and there has been no recurrence to date. It is now three years and five months since her operation.

Case 4.—Mr. C., aged sixty-eight, was first examined March 26, 1932. He stated that during the past six months he had noticed blood in the stool, with diarrhea and cramp-like pains. At the time he reported for examination he had had complete obstruction for ten days and there was a great deal of bleeding. He was a very weak, frail individual, almost entirely deaf. Hemoglobin 60, R.B.C. 3,580,000. The urine was negative. He had to be supported on the table by two individuals during the proctoscopic examination, which revealed a large proliferating carcinoma at the rectal shelf and in the first part of the sigmoid. His abdomen was distended and he was suffering from obstruction.

On March 28, 1932, the growth was completely destroyed by electrocoagulation. Microscopic examination showed adenocarcinoma, Grade 3. His recovery was uneventful, he had normal stools and began to regain his former strength. On April 15, 1932, he was re-examined and there remained a small amount of pedunculated carcinomatous tissue in the lower sigmoid. This was destroyed by electrocoagulation.

He was again re-examined on June 25, 1932; there was complete healing and no evidence of any growth. He regained his former strength and weight, was able to get about as usual, and had normal stools until March 4, 1933, when he reported again and we found extensive recurrence at the site of the old lesion. The growth was again completely destroyed by electrocoagulation. On April 17, 1933, examination revealed no evidence of growth. On June 2, 1933, he reported again with a large recurrence. He was advised to have a colostomy, which he refused, as he had done on previous occasions. However, on July 4, 1933, he became completely obstructed and a colostomy was done at his home, which he scarcely survived, and constantly grew weaker and died February 9, 1934, one year and eleven months after his first operation. This is an example of a very malignant, rapidly growing carcinoma, and it is quite probable that he would have had a prompt recurrence following any type of radical operation.

Case 5.—Mrs. V., aged seventy-two, was first examined August 17, 1932. She complained of bloody discharge from the rectum during the past eight months, with a great deal of diarrhea and pain in the lower abdomen. She had lost ten pounds in weight and for the past week had not had a stool. Proctoscopic examination revealed a large obstructing annular carcinoma at the recto-sigmoidal junction.

On September 7, 1932, the growth was thoroughly destroyed by electrocoagulation and the microscopic examination revealed adenocarcinoma. She was re-examined on November 2, 1932, at which time there was a small recurrence, or remaining portion which had not previously been destroyed, and which was again coagulated. After this she improved considerably, was up and about, had normal stools and gained in weight, until September 2, 1933, when she was seized with a very severe pain in the abdomen. She soon became distended, apparently had a perforation of the bowel resulting in a general peritonitis. She died three days later, one year after the first operation. We were unable to obtain a post mortem.

Case 6.—Mrs. E., aged seventy-eight, was admitted to the hospital February 14, 1933, because of severe recurrent rectal hemorrhages for several months. She was a very frail old lady, was almost completely deaf and was extremely emaciated. She had to be supported during the proctoscopic examination, which revealed several masses of soft gelatinous carcinoma extending from just above the rectal sphincter into the lower sigmoid, at which point the bowel was almost completely closed. The area about the valves was literally filled with this soft gelatinous growth. She developed a bronchopneumonia and nothing could be done at that time.

On March 16, 1933, about a month after her admission, under local anesthesia, all the masses were completely coagulated. Microscopic examination showed adenocarcinoma, Grade 4. She was in stupor for a considerable time, had Cheyne-Stokes respiration, pulse was imperceptible, blood pressure 54 systolic, 30 diastolic. She recovered, got out of bed, and regained her strength. On April 5, 1933, she was re-examined and a large mass was found on the first valve. This was thoroughly coagulated. She rapidly regained her health and was discharged from the hospital on May 6, 1933. She had a good appetite and had normal stools until March 20, 1934, when she was readmitted for examination. At this time there was a recurrence just beyond the rectal shelf. This was thoroughly coagulated and she was discharged April 2, 1934. She remained in good health until September 2, 1934, when she was re-admitted with intestinal obstruction. There was extensive recurrence in the bowel, almost completely blocking its lumen, and the liver was enlarged and filled with nodules. There were large carcinomatous masses in the right supra-clavicular area, the left upper jaw, and multiple nodules in the scalp. She died September 14, 1934, one year and six months after the original operation.

Case 7.—Mrs. D., aged eighty-four, was first examined November 11, 1933. She gave a history that she had had constipation and bleeding from the rectum for the past three months. Proctoscopic examination revealed a proliferating carcinoma in the lower sigmoid. The growth was very soft and there was extensive bleeding on sponging. She was a very frail old lady, weighing about 80 pounds, had a systolic murmur at the apex, hemoglobin of 68, and on general examination she was not considered a suitable risk for radical operation.

On January 5, 1934, the growth was completely destroyed by electrocoagulation. Microscopic examination showed an adenocarcinoma, Grade 4. Since that time she has been up and about, there has been no weight loss and she has had regular stools. About a month ago she noticed a little bleeding. On March 28, 1935, proctoscopic examination revealed that there is a moderate recurrence at the site of the old tumor, which will again have to be coagulated.

Case 8.—Mrs. J., seventy-three years of age, was admitted March 19, 1934, because of severe hemorrhage from the bowel. She stated that she had had some bleeding on occasions during the past two years and had lost 28 pounds in weight. Proctoscopic examination revealed a soft elevated carcinoma at the rectal shelf extending up into the sigmoid. She was much emaciated, had a hemoglobin of 50, and electrocardiogram revealed definite myocardial degeneration. She complained frequently of anginal attacks, lasting over two hours.

On March 21, 1934, the growth was thoroughly destroyed by electrocoagulation. She had an uneventful postoperative course and was discharged from the hospital April 1, 1934. Microscopic examination revealed adenocarcinoma, Grade 3.

On July 31, 1934, she was again examined and there was some recurrence, or a remaining portion of carcinoma found. This was again destroyed by electrocoagulation. She has not been examined since that time but in a communication from her during the past week she states that she is having considerable abdominal cramps. It is probable that she has either a constriction or a recurrence.

Conclusions

1. Electrocoagulation is not intended to replace radical operation in patients who are considered surgical risks.

2. A carcinoma located in the extraperitoneal portion of the rectum, that has not penetrated into surrounding structures, can be completely destroyed by electrocoagulation.

3. If the growth is located in the intraperitoneal area, and is extensive, electrocoagulation can only be considered a palliative treatment.

4. Electrocoagulation is particularly suitable in the aged individual, who is inoperable, and whose life expectancy is short. It is our duty to give them as much comfort as possible during that short period.

BOOK REVIEWS

Books listed here become the property of the Ramsey and Hennepin County Medical libraries when reviewed. Members, however, are urged to write reviews of any or every recent book which may be of interest to physicians.

DISEASES OF THE MOUTH AND THEIR TREATMENT. By Herman Prinz, A.M., D.D.S., M.D., D.Sc., D.M.D., Professor of Materia Medica and Therapeutics, The Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania; and Sigmund S. Greenbaum, B.S., M.D., Associate Professor of Dermatology and Syphilology in the Graduate School of Medicine of the University of Pennsylvania; Attending Dermatologist, Mt. Sinai and Philadelphia General Hospitals. Published by Lea & Febiger, Philadelphia. Price $9.00.

Diseases of the Mouth and Their Treatment presents an ideal combination of authors on the subject of the medico-dental problems met in general practice. Dr. Prinz needs no introduction to the dental profession, having written extensively on materia medica and therapeutics and being the author of a book on that subject. Dr. Greenbaum's wide teaching and clinical experience in dermatology and pathologic problems complete this combination.

The publication gives a complete presentation of oral disease including those of local origin and manifestations of systemic disturbances. The authors present an enormous mass of material on the subject of mouth disease covering all forms and describe many unusual and rare cases. Etiology, symptomatology, bacteriology, diagnosis, prognosis and treatment are all considered. Profuse illustrations add to the value and interest for the reader. The book is of particular interest for consultation and reference.

The chapters on oral manifestations of metabolic derangement and avitaminosis are indeed timely, with the increasing evidence of the association of nutritional unbalance and oral disease. The discussion on tumors and cysts contains only macroscopic illustrations. The omission of microscopic plates is due, no doubt, to the fact that the book is intended as a consultant for practitioners rather than as a pathological text. A valuable introduction to the book is a review of anatomy and physiology of the oral cavity.

In collaboration with the authors many well known writers have added much of value in several chapters. The book is thoroughly up-to-date and complete in its treatment of the subject.

CARL T. GROVE, D.D.S.

DOCTORS AND JURIES. Humphreys Springstun of the Detroit Bar. 155 pages. $2.00. Philadelphia: P. Blakiston's Son & Co., Inc., 1935.

The first five chapters are mostly devoted to defining the various terms of law in regard to medical practice. Under the chapter of Warrantees there is special reference given in regard to the liability of the physician when he makes specific promises to the patient as to the results of his treatments.

It would be well for all physicians to read the various chapters on how to conduct oneself in court. There are several good thoughts listed which should be carefully studied.

The last few chapters are devoted to insanity in regard to degree, crime, contracts, and wills, and under the chapter on Proof of Insanity, one is surprised to read that the law does not recognize expert testimony upon the subject as being of any greater value than that of ordinary persons although the jury probably would take the physician's testimony as being of greater value than the ordinary layman's.

The book is concise and easily read, and, to anyone frequently called into court, it is well worth reading.

EDWARD C. GIBBS, M.D.

TEXTBOOK OF SURGERY. W. Wayne Babcock, M.D., F.A.C.P. 2d ed. rev. 1312 pages. Illus. Price $10.00. Philadelphia: W. B. Saunders Company, 1935.

This text of surgery is a well compounded résumé of all the common surgical diseases and most of the unusual surgical conditions which one could encounter in a lifetime. It deals briefly with the symptoms, signs, diagnosis and treatment of these diseases. Its pages are beautifully illustrated and helpful anatomic, pathologic and diagrammatic drawings which make it helpful to better advantage than thousands of descriptive words have done. It does not aim to present a treatise on any phase of surgery but serves well in pointing out the fundamental details which are so essential for those who would desire to refresh their memories on its numerous subjects.

To have written this book must have entailed numerous long hours of conscientious labor, but to have planned it and to have experienced a practice representing its contents seems almost beyond the abilities of human endeavor.

CARL O. RICE, M.D.